

# SEQUENCE LISTING

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<120> PUFA Polyketide Synthase Systems and Uses Thereof

<130> 2997-49

<150> 10/124,800

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<170> PatentIn version 3.2

<210> 1

<211> 8730

<212> DNA

<213> Schizochytrium sp.

<220>

<221> CDS

<222> (1)..(8730)

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Arg Glu Ser Trp Glu Thr Ile Arg Ala Gly Ile Asp Cys Leu Ser Asp	
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Leu Pro Glu Asp Arg Val Asp Val Thr Ala Tyr Phe Asp Pro Val Lys	
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Tyr Asp Phe Asp Ala Arg Glu Phe Gly Leu Asn Met Phe Gln Met Glu	
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Thr Ala Tyr Arg Leu Asn Lys Arg Pro Gln Pro Val Leu Met Met Ala	
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Ala Thr Pro Ala Ala Leu Gln Ser Leu Cys Glu Ala Gln Leu Lys Glu	
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Ala Gly Ser Asp Lys Asp Phe Glu Arg Val Ser Gln Val Leu Tyr Pro	
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980 985 990	
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995 1000 1005	
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Glu Ala Glu Arg Leu Gln Lys Glu Leu Gln Asp Ala Gln Arg Gln	
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Leu Asp Asp Ala Lys Arg Ala Ala Ala Glu Ala Asn Ser Lys Leu	
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Lys Ser Met Leu Ala Glu Leu Asp Gly Tyr Gly Ser Val Asp Ala	
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Arg Thr Val Gly Glu Val Val	Asn Ala Met Lys Ala	Glu Ile Ala	
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 <212> PRT  
 <213> Schizochytrium sp.

<400> 2

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Ile Ala Ile Ile Gly Met Ser Ala Ile Leu Pro Cys Gly Thr Thr Val
20 25 30

Arg Glu Ser Trp Glu Thr Ile Arg Ala Gly Ile Asp Cys Leu Ser Asp
35 40 45

Leu Pro Glu Asp Arg Val Asp Val Thr Ala Tyr Phe Asp Pro Val Lys
50 55 60



Thr Thr Lys Asp Lys Ile Tyr Cys Lys Arg Gly Gly Phe Ile Pro Glu  
65 70 75 80

Tyr Asp Phe Asp Ala Arg Glu Phe Gly Leu Asn Met Phe Gln Met Glu  
85 90 95

Asp Ser Asp Ala Asn Gln Thr Ile Ser Leu Leu Lys Val Lys Glu Ala  
100 105 110

Leu Gln Asp Ala Gly Ile Asp Ala Leu Gly Lys Glu Lys Lys Asn Ile  
115 120 125

Gly Cys Val Leu Gly Ile Gly Gly Gly Gln Lys Ser Ser His Glu Phe  
130 135 140

Tyr Ser Arg Leu Asn Tyr Val Val Val Glu Lys Val Leu Arg Lys Met  
145 150 155 160

Gly Met Pro Glu Glu Asp Val Lys Val Ala Val Glu Lys Tyr Lys Ala  
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Asn Phe Pro Glu Trp Arg Leu Asp Ser Phe Pro Gly Phe Leu Gly Asn  
180 185 190

Val Thr Ala Gly Arg Cys Thr Asn Thr Phe Asn Leu Asp Gly Met Asn  
195 200 205

Cys Val Val Asp Ala Ala Cys Ala Ser Ser Leu Ile Ala Val Lys Val  
210 215 220

Ala Ile Asp Glu Leu Leu Tyr Gly Asp Cys Asp Met Met Val Thr Gly  
225 230 235 240

Ala Thr Cys Thr Asp Asn Ser Ile Gly Met Tyr Met Ala Phe Ser Lys  
245 250 255

Thr Pro Val Phe Ser Thr Asp Pro Ser Val Arg Ala Tyr Asp Glu Lys  
260 265 270

Thr Lys Gly Met Leu Ile Gly Glu Gly Ser Ala Met Leu Val Leu Lys  
275 280 285

Arg Tyr Ala Asp Ala Val Arg Asp Gly Asp Glu Ile His Ala Val Ile  
290 295 300

Arg Gly Cys Ala Ser Ser Ser Asp Gly Lys Ala Ala Gly Ile Tyr Thr  
305 310 315 320

Pro Thr Ile Ser Gly Gln Glu Glu Ala Leu Arg Arg Ala Tyr Asn Arg  
325 330 335

Ala Cys Val Asp Pro Ala Thr Val Thr Leu Val Glu Gly His Gly Thr  
340 345 350

Gly Thr Pro Val Gly Asp Arg Ile Glu Leu Thr Ala Leu Arg Asn Leu  
355 360 365

Phe Asp Lys Ala Tyr Gly Glu Gly Asn Thr Glu Lys Val Ala Val Gly  
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Ser Ile Lys Ser Ser Ile Gly His Leu Lys Ala Val Ala Gly Leu Ala  
385 390 395 400

Gly Met Ile Lys Val Ile Met Ala Leu Lys His Lys Thr Leu Pro Gly  
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Thr Ile Asn Val Asp Asn Pro Pro Asn Leu Tyr Asp Asn Thr Pro Ile  
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Asn Glu Ser Ser Leu Tyr Ile Asn Thr Met Asn Arg Pro Trp Phe Pro  
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Pro Pro Gly Val Pro Arg Arg Ala Gly Ile Ser Ser Phe Gly Phe Gly  
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Gly Ala Asn Tyr His Ala Val Leu Glu Glu Ala Glu Pro Glu His Thr  
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Thr Ala Tyr Arg Leu Asn Lys Arg Pro Gln Pro Val Leu Met Met Ala  
485 490 495

Ala Thr Pro Ala Ala Leu Gln Ser Leu Cys Glu Ala Gln Leu Lys Glu  
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Phe Glu Ala Ala Ile Lys Glu Asn Glu Thr Val Lys Asn Thr Ala Tyr  
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Ile Lys Cys Val Lys Phe Gly Glu Gln Phe Lys Phe Pro Gly Ser Ile  
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Pro Ala Thr Asn Ala Arg Leu Gly Phe Leu Val Lys Asp Ala Glu Asp  
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Ala Cys Ser Thr Leu Arg Ala Ile Cys Ala Gln Phe Ala Lys Asp Val  
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Thr Lys Glu Ala Trp Arg Leu Pro Arg Glu Gly Val Ser Phe Arg Ala  
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Lys Gly Ile Ala Thr Asn Gly Ala Val Ala Ala Leu Phe Ser Gly Gln  
595 600 605

Gly Ala Gln Tyr Thr His Met Phe Ser Glu Val Ala Met Asn Trp Pro  
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Gln Phe Arg Gln Ser Ile Ala Ala Met Asp Ala Ala Gln Ser Lys Val  
 625 630 635 640

Ala Gly Ser Asp Lys Asp Phe Glu Arg Val Ser Gln Val Leu Tyr Pro  
 645 650 655

Arg Lys Pro Tyr Glu Arg Glu Pro Glu Gln Asn Pro Lys Lys Ile Ser  
 660 665 670

Leu Thr Ala Tyr Ser Gln Pro Ser Thr Leu Ala Cys Ala Leu Gly Ala  
 675 680 685

Phe Glu Ile Phe Lys Glu Ala Gly Phe Thr Pro Asp Phe Ala Ala Gly  
 690 695 700

His Ser Leu Gly Glu Phe Ala Ala Leu Tyr Ala Ala Gly Cys Val Asp  
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Arg Asp Glu Leu Phe Glu Leu Val Cys Arg Arg Ala Arg Ile Met Gly  
 725 730 735

Gly Lys Asp Ala Pro Ala Thr Pro Lys Gly Cys Met Ala Ala Val Ile  
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Gly Pro Asn Ala Glu Asn Ile Lys Val Gln Ala Ala Asn Val Trp Leu  
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Gly Asn Ser Asn Ser Pro Ser Gln Thr Val Ile Thr Gly Ser Val Glu  
 770 775 780

Gly Ile Gln Ala Glu Ser Ala Arg Leu Gln Lys Glu Gly Phe Arg Val  
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Val Pro Leu Ala Cys Glu Ser Ala Phe His Ser Pro Gln Met Glu Asn  
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Ala Ser Ser Ala Phe Lys Asp Val Ile Ser Lys Val Ser Phe Arg Thr  
 820 825 830

Pro Lys Ala Glu Thr Lys Leu Phe Ser Asn Val Ser Gly Glu Thr Tyr  
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Pro Thr Asp Ala Arg Glu Met Leu Thr Gln His Met Thr Ser Ser Val  
 850 855 860

Lys Phe Leu Thr Gln Val Arg Asn Met His Gln Ala Gly Ala Arg Ile  
 865 870 875 880

Phe Val Glu Phe Gly Pro Lys Gln Val Leu Ser Lys Leu Val Ser Glu  
 885 890 895  
 Thr Leu Lys Asp Asp Pro Ser Val Val Thr Val Ser Val Asn Pro Ala  
 900 905 910  
 Ser Gly Thr Asp Ser Asp Ile Gln Leu Arg Asp Ala Ala Val Gln Leu  
 915 920 925  
 Val Val Ala Gly Val Asn Leu Gln Gly Phe Asp Lys Trp Asp Ala Pro  
 930 935 940  
 Asp Ala Thr Arg Met Gln Ala Ile Lys Lys Lys Arg Thr Thr Leu Arg  
 945 950 955 960  
 Leu Ser Ala Ala Thr Tyr Val Ser Asp Lys Thr Lys Lys Val Arg Asp  
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 Ala Ala Met Asn Asp Gly Arg Cys Val Thr Tyr Leu Lys Gly Ala Ala  
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 Pro Leu Ile Lys Ala Pro Glu Pro Val Val Asp Glu Ala Ala Lys Arg  
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 Pro Ala Val Asp Thr Ala Val Val Glu Lys His Arg Ala Ile Leu  
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 Lys Ser Met Leu Ala Glu Leu Asp Gly Tyr Gly Ser Val Asp Ala  
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 Ser Ser Leu Gln Gln Gln Gln Gln Gln Gln Thr Ala Pro Ala Pro  
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 Val Lys Ala Ala Ala Pro Ala Ala Pro Val Ala Ser Ala Pro Ala  
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 Pro Ala Val Ser Asn Glu Leu Leu Glu Lys Ala Glu Thr Val Val  
 1115 1120 1125  
 Met Glu Val Leu Ala Ala Lys Thr Gly Tyr Glu Thr Asp Met Ile  
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Glu Ala	Asp Met	Glu Leu	Glu Thr	Glu Leu	Gly Ile	Asp Ser	Ile		
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Lys Arg	Val Glu	Ile Leu	Ser Glu	Val Gln	Ala Met	Leu Asn	Val		
1160			1165		1170				
Glu Ala	Lys Asp	Val Asp	Ala Leu	Ser Arg	Thr Arg	Thr Val	Gly		
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Glu Val	Val Asn	Ala Met	Lys Ala	Glu Ile	Ala Gly	Ser Ser	Ala		
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1205			1210		1215				
Ala Ala	Ala Ala	Pro Ala	Val Ser	Asn Glu	Leu Leu	Glu Lys	Ala		
1220			1225		1230				
Glu Thr	Val Val	Met Glu	Val Leu	Ala Ala	Lys Thr	Gly Tyr	Glu		
1235			1240		1245				
Thr Asp	Met Ile	Glu Ser	Asp Met	Glu Leu	Glu Thr	Glu Leu	Gly		
1250			1255		1260				
Ile Asp	Ser Ile	Lys Arg	Val Glu	Ile Leu	Ser Glu	Val Gln	Ala		
1265			1270		1275				
Met Leu	Asn Val	Glu Ala	Lys Asp	Val Asp	Ala Leu	Ser Arg	Thr		
1280			1285		1290				
Arg Thr	Val Gly	Glu Val	Val Asn	Ala Met	Lys Ala	Glu Ile	Ala		
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Gly Gly	Ser Ala	Pro Ala	Pro Ala	Ala Ala	Ala Ala	Pro Gly	Pro Ala		
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Ala Ala	Ala Pro	Ala Pro	Ala Ala	Ala Ala	Pro Ala	Val Ser	Asn		
1325			1330		1335				
Glu Leu	Leu Glu	Lys Ala	Glu Thr	Val Val	Met Glu	Val Leu	Ala		
1340			1345		1350				
Ala Lys	Thr Gly	Tyr Glu	Thr Asp	Met Ile	Glu Ser	Asp Met	Glu		
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Leu Glu	Thr Glu	Leu Gly	Ile Asp	Ser Ile	Lys Arg	Val Glu	Ile		
1370			1375		1380				
Leu Ser	Glu Val	Gln Ala	Met Leu	Asn Val	Glu Ala	Lys Asp	Val		
1385			1390		1395				

Asp Ala Leu Ser Arg Thr Arg Thr Val Gly Glu Val Val Asp Ala  
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Met Lys Ala Glu Ile Ala Gly Gly Ser Ala Pro Ala Pro Ala Ala  
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Ala Ala Pro Ala Pro Ala Ala Ala Ala Pro Ala Pro Ala Ala Pro  
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Ala Pro Ala Val Ser Ser Glu Leu Leu Glu Lys Ala Glu Thr Val  
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Val Met Glu Val Leu Ala Ala Lys Thr Gly Tyr Glu Thr Asp Met  
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Ile Glu Ser Asp Met Glu Leu Glu Thr Glu Leu Gly Ile Asp Ser  
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Leu Ala Ala Lys Thr Gly Tyr Glu Thr Asp Met Ile Glu Ser Asp  
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 1595 1600 1605

Glu Ile Leu Ser Glu Val Gln Ala Met Leu Asn Val Glu Ala Lys  
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Asp Val Asp Ala Leu Ser Arg Thr Arg Thr Val Gly Glu Val Val  
 1625 1630 1635

Asp Ala Met Lys Ala Glu Ile Ala Gly Ser Ser Ala Ser Ala Pro  
 1640 1645 1650

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1670						1675					1680			
Thr	Val	Val	Met	Glu	Val	Leu	Ala	Ala	Lys	Thr	Gly	Tyr	Glu	Thr
1685						1690					1695			
Asp	Met	Ile	Glu	Ser	Asp	Met	Glu	Leu	Glu	Thr	Glu	Leu	Gly	Ile
1700						1705					1710			
Asp	Ser	Ile	Lys	Arg	Val	Glu	Ile	Leu	Ser	Glu	Val	Gln	Ala	Met
1715						1720					1725			
Leu	Asn	Val	Glu	Ala	Lys	Asp	Val	Asp	Ala	Leu	Ser	Arg	Thr	Arg
1730						1735					1740			
Thr	Val	Gly	Glu	Val	Val	Asp	Ala	Met	Lys	Ala	Glu	Ile	Ala	Gly
1745						1750					1755			
Gly	Ser	Ala	Pro	Ala	Pro	Ala	Ala	Ala	Ala	Pro	Ala	Pro	Ala	Ala
1760						1765					1770			
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1775						1780					1785			
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1790						1795					1800			
Met	Ile	Glu	Ser	Asp	Met	Glu	Leu	Glu	Thr	Glu	Leu	Gly	Ile	Asp
1805						1810					1815			
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1820						1825					1830			
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1835						1840					1845			
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1865						1870					1875			
Ala	Pro	Ala	Pro	Ala	Ala	Ala	Ala	Pro	Ala	Val	Ser	Ser	Glu	Leu
1880						1885					1890			
Leu	Glu	Lys	Ala	Glu	Thr	Val	Val	Met	Glu	Val	Leu	Ala	Ala	Lys
1895						1900					1905			

Thr Gly 1910	Tyr Glu Thr Asp 1915	Met 1920	Ile Glu Ser Asp 1925	Glu Leu Glu 1930
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Glu Val 1940	Gln Ala Met Leu 1945	Asn 1950	Val Glu Ala Lys Asp 1955	Val Asp Ala 1960
Leu Ser 1955	Arg Thr Arg Thr 1960	Val 1965	Gly Glu Val Val Asp 1970	Ala Met Lys 1975
Ala Glu 1970	Ile Ala Gly Gly 1975	Ser 1980	Ala Pro Ala Pro 1985	Ala Ala Ala 1990
Pro Ala 1985	Pro Ala Ala Ala 1990	Ala 1995	Pro Ala Val Ser 2000	Asn Glu Leu Leu 2005
Glu Lys 2000	Ala Glu Thr Val 2005	Val 2010	Met Glu Val Leu 2015	Ala Ala Lys Thr 2020
Gly Tyr 2015	Glu Thr Asp Met 2020	Ile 2025	Glu Ser Asp Met 2030	Glu Leu Glu Thr 2035
Glu Leu 2030	Gly Ile Asp Ser 2035	Ile 2040	Lys Arg Val Glu 2045	Ile Leu Ser Glu 2050
Val Gln 2045	Ala Met Leu Asn 2050	Val 2055	Glu Ala Lys Asp 2060	Val Asp Ala Leu 2065
Ser Arg 2060	Thr Arg Thr Val 2065	Gly 2070	Glu Val Val Asp 2075	Ala Met Lys Ala 2080
Glu Ile 2075	Ala Gly Gly Ser 2080	Ala 2085	Pro Ala Pro Ala 2090	Ala Ala Ala Pro 2095
Ala Ser 2090	Ala Gly Ala Ala 2095	Pro 2100	Ala Val Lys Ile 2105	Asp Ser Val His 2110
Gly Ala 2105	Asp Cys Asp Asp 2110	Leu 2115	Ser Leu Met His 2120	Ala Lys Val Val 2125
Asp Ile 2120	Arg Arg Pro Asp 2125	Glu 2130	Leu Ile Leu Glu 2135	Arg Pro Glu Asn 2140
Arg Pro 2135	Val Leu Val Val 2140	Asp 2145	Asp Gly Ser Glu 2150	Leu Thr Leu Ala 2155
Leu Val 2150	Arg Val Leu Gly 2155	Ala 2160	Cys Ala Val Val 2165	Leu Thr Phe Glu 2170



Gly	Leu	Gln	Leu	Ala	Gln	Arg	Ala	Gly	Ala	Ala	Ala	Ile	Arg	His
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Val	Leu	Ala	Lys	Asp	Leu	Ser	Ala	Glu	Ser	Ala	Glu	Lys	Ala	Ile
2180						2185					2190			
Lys	Glu	Ala	Glu	Gln	Arg	Phe	Gly	Ala	Leu	Gly	Gly	Phe	Ile	Ser
2195						2200					2205			
Gln	Gln	Ala	Glu	Arg	Phe	Glu	Pro	Ala	Glu	Ile	Leu	Gly	Phe	Thr
2210						2215					2220			
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2225						2230					2235			
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2240						2245					2250			
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Lys Asp Glu Phe Trp Glu Val Leu Met Asn Gly Lys Val Glu Ser Lys
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gtg atc agc gac aaa cga ctc ggc tcc aac tac cgc gcc gag cac tac      192
Val Ile Ser Asp Lys Arg Leu Gly Ser Asn Tyr Arg Ala Glu His Tyr
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Lys Ala Glu Arg Ser Lys Tyr Ala Asp Thr Phe Cys Asn Glu Thr Tyr
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Gly Thr Leu Asp Glu Asn Glu Ile Asp Asn Glu His Glu Leu Leu Leu
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Asn Leu Ala Lys Gln Ala Leu Ala Glu Thr Ser Val Lys Asp Ser Thr
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Gln Gly Glu Leu Leu Asn Val Tyr Gln Asn His Val Glu Lys Lys Leu
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Ser Asn Lys Pro Glu Ala Gly Asp Arg Arg Ile Phe Met Asp Pro Ala
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His Leu Val Ser Gly Ala Ala Asp Val Met Leu Cys Gly Ala Thr Cys
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Tyr Lys Gln Asn Tyr Asp Val Phe Val Glu Val Gly Pro Asn Asn			
1340	1345	1350	
cac cgt agc acc gca gtg cgc acc acg ctt ggt ccc cag cgc aac			4104
His Arg Ser Thr Ala Val Arg Thr Thr Leu Gly Pro Gln Arg Asn			
1355	1360	1365	
cac ctt gct ggc gcc atc gac aag cag aac gag gat gct tgg acg			4149
His Leu Ala Gly Ala Ile Asp Lys Gln Asn Glu Asp Ala Trp Thr			
1370	1375	1380	
acc atc gtc aag ctt gtg gct tcg ctc aag gcc cac ctt gtt cct			4194
Thr Ile Val Lys Leu Val Ala Ser Leu Lys Ala His Leu Val Pro			
1385	1390	1395	
ggc gtc acg atc tcg ccg ctg tac cac tcc aag ctt gtg gcg gag			4239
Gly Val Thr Ile Ser Pro Leu Tyr His Ser Lys Leu Val Ala Glu			
1400	1405	1410	
gct cag gct tgc tac gct gcg ctc tgc aag ggt gaa aag ccc aag			4284
Ala Gln Ala Cys Tyr Ala Ala Leu Cys Lys Gly Glu Lys Pro Lys			
1415	1420	1425	
aag aac aag ttt gtg cgc aag att cag ctc aac ggt cgc ttc aac			4329
Lys Asn Lys Phe Val Arg Lys Ile Gln Leu Asn Gly Arg Phe Asn			
1430	1435	1440	
agc aag gcg gac ccc atc tcc tcg gcc gat ctt gcc agc ttt ccg			4374
Ser Lys Ala Asp Pro Ile Ser Ser Ala Asp Leu Ala Ser Phe Pro			
1445	1450	1455	
cct gcg gac cct gcc att gaa gcc gcc atc tcg agc cgc atc atg			4419
Pro Ala Asp Pro Ala Ile Glu Ala Ala Ile Ser Ser Arg Ile Met			
1460	1465	1470	
aag cct gtc gct ccc aag ttc tac gcg cgt ctc aac att gac gag			4464
Lys Pro Val Ala Pro Lys Phe Tyr Ala Arg Leu Asn Ile Asp Glu			
1475	1480	1485	
cag gac gag acc cga gat ccg atc ctc aac aag gac aac gcg ccg			4509
Gln Asp Glu Thr Arg Asp Pro Ile Leu Asn Lys Asp Asn Ala Pro			
1490	1495	1500	
tct tct tct tct tct tct tct tct tct tct tct tct tct tct			4554
Ser Ser Ser Ser Ser Ser Ser Ser Ser Ser Ser Ser Ser Ser			
1505	1510	1515	
ccg tcg cct gct cct tcg gcc ccc gtg caa aag aag gct gct ccc			4599
Pro Ser Pro Ala Pro Ser Ala Pro Val Gln Lys Lys Ala Ala Pro			
1520	1525	1530	
gcc gcg gag acc aag gct gtt gct tcg gct gac gca ctt cgc agt			4644
Ala Ala Glu Thr Lys Ala Val Ala Ser Ala Asp Ala Leu Arg Ser			
1535	1540	1545	
gcc ctg ctc gat ctc gac agt atg ctt gcg ctg agc tct gcc agt			4689
Ala Leu Leu Asp Leu Asp Ser Met Leu Ala Leu Ser Ser Ala Ser			
1550	1555	1560	
gcc tcc gcc aac ctt gtt gag act gcg cct agc gac gcc tgg gtc			4734
Ala Ser Gly Asn Leu Val Glu Thr Ala Pro Ser Asp Ala Ser Val			

1565	1570	1575	
att gtg ccg ccc tgc aac Ile Val Pro Pro Cys Asn 1580	att gcg gat ctc ggc Ile Ala Asp Leu Gly 1585	agc cgc gcc ttc Ser Arg Ala Phe 1590	4779
atg aaa acg tac ggt gtt tgc Met Lys Thr Tyr Gly Val Ser 1595	gcg cct ctg tac Ala Pro Leu Tyr 1600	acg ggc gcc atg Thr Gly Ala Met 1605	4824
gcc aag ggc att gcc tct gcg Ala Lys Gly Ile Ala Ser 1610	gac ctc gtc att Asp Leu Val Ile 1615	gcc gcc ggc cgc Ala Ala Gly Arg 1620	4869
cag ggc atc ctt gcg tcc ttt Gln Gly Ile Leu Ala Ser Phe 1625	ggc gcc ggc gga Gly Ala Gly Gly 1630	ctt ccc atg cag Leu Pro Met Gln 1635	4914
gtt gtg cgt gag tcc atc gaa Val Val Arg Glu Ser Ile Glu 1640	aag att cag gcc Lys Ile Gln Ala 1645	gcc gcc ctg ccc aat Ala Ala Leu Pro Asn 1650	4959
ggc ccg tac gct gtc aac ctt Gly Pro Tyr Ala Val Asn Leu 1655	atc cat tct ccc Ile His Ser Pro 1660	ttt gac agc aac Phe Asp Ser Asn 1665	5004
ctc gaa aag ggc aat gtc gat Leu Glu Lys Gly Asn Val Asp 1670	ctc ttc ctc gag Leu Phe Leu Glu 1675	aag ggt gtc acc Lys Gly Val Thr 1680	5049
ttt gtc gag gcc tgc gcc ttt Phe Val Glu Ala Ser Ala Phe 1685	atg acg ctc acc Met Thr Leu Thr 1690	ccg cag gtc gtg Pro Gln Val Val 1695	5094
cgg tac cgc gcg gct ggc ctc Arg Tyr Arg Ala Ala Gly Leu 1700	acg cgc aac gcc Thr Arg Asn Ala 1705	gac ggc tgc gtc Asp Gly Ser Val 1710	5139
aac atc cgc aac cgt atc att Asn Ile Arg Asn Arg Ile Ile 1715	ggc aag gtc tgc Gly Lys Val Ser 1720	cgc acc gag ctc Arg Thr Glu Leu 1725	5184
gcc gag atg ttc atg cgt cct Ala Glu Met Phe Met Arg Pro 1730	gcg ccc gag cac Ala Pro Glu His 1735	ctt ctt cag aag Leu Leu Gln Lys 1740	5229
ctc att gct tcc ggc gag atc Leu Ile Ala Ser Gly Glu Ile 1745	aac cag gag cag Asn Gln Glu Gln 1750	gcc gag ctc gcc Ala Glu Leu Ala 1755	5274
cgc cgt gtt ccc gtc gct gac Arg Arg Val Pro Val Ala Asp 1760	gac atc gcg gtc Asp Ile Ala Val 1765	gaa gct gac tgc Glu Ala Asp Ser 1770	5319
ggt ggc cac acc gac aac cgc Gly Gly His Thr Asp Asn Arg 1775	ccc atc cac gtc Pro Ile His Val 1780	att ctg ccc ctc Ile Leu Pro Leu 1785	5364
atc atc aac ctt cgc gac cgc Ile Ile Asn Leu Arg Asp Arg 1790	ctt cac cgc gag Leu His Arg Glu 1795	tgc ggc tac ccg Cys Gly Tyr Pro 1800	5409
gcc aac ctt cgc gtc cgt gtg Ala Asn Leu Arg Val Arg Val 1805	ggc gcc ggc ggt Gly Ala Gly Gly 1810	ggc att ggg tgc Gly Ile Gly Cys 1815	5454
ccc cag gcg gcg ctg gcc acc Pro Gln Ala Ala Leu Ala Thr 1820	ttc aac atg ggt Phe Asn Met Gly 1825	gcc tcc ttt att Ala Ser Phe Ile 1830	5499

1820	1825	1830	
gtc acc ggc acc gtg aac cag gtc gcc aag cag tcg ggc acg tgc Val Thr Gly Thr Val Asn Gln Val Ala Lys Gln Ser Gly Thr Cys 1835 1840 1845			5544
gac aat gtg cgc aag cag ctc gcg aag gcc act tac tcg gac gta Asp Asn Val Arg Lys Gln Leu Ala Lys Ala Thr Tyr Ser Asp Val 1850 1855 1860			5589
tgc atg gcc ccg gct gcc gac atg ttc gag gaa ggc gtc aag ctt Cys Met Ala Pro Ala Ala Asp Met Phe Glu Glu Gly Val Lys Leu 1865 1870 1875			5634
cag gtc ctc aag aag gga acc atg ttt ccc tcg cgc gcc aac aag Gln Val Leu Lys Lys Gly Thr Met Phe Pro Ser Arg Ala Asn Lys 1880 1885 1890			5679
ctc tac gag ctc ttt tgc aag tac gac tcg ttc gag tcc atg ccc Leu Tyr Glu Leu Phe Cys Lys Tyr Asp Ser Phe Glu Ser Met Pro 1895 1900 1905			5724
ccc gca gag ctt gcg cgc gtc gag aag cgc atc ttc agc cgc gcg Pro Ala Glu Leu Ala Arg Val Glu Lys Arg Ile Phe Ser Arg Ala 1910 1915 1920			5769
ctc gaa gag gtc tgg gac gag acc aaa aac ttt tac att aac cgt Leu Glu Glu Val Trp Asp Glu Thr Lys Asn Phe Tyr Ile Asn Arg 1925 1930 1935			5814
ctt cac aac ccg gag aag atc cag cgc gcc gag cgc gac ccc aag Leu His Asn Pro Glu Lys Ile Gln Arg Ala Glu Arg Asp Pro Lys 1940 1945 1950			5859
ctc aag atg tcg ctg tgc ttt cgc tgg tac ctg agc ctg gcg agc Leu Lys Met Ser Leu Cys Phe Arg Trp Tyr Leu Ser Leu Ala Ser 1955 1960 1965			5904
cgc tgg gcc aac act gga gct tcc gat cgc gtc atg gac tac cag Arg Trp Ala Asn Thr Gly Ala Ser Asp Arg Val Met Asp Tyr Gln 1970 1975 1980			5949
gtc tgg tgc ggt cct gcc att ggt tcc ttc aac gat ttc atc aag Val Trp Cys Gly Pro Ala Ile Gly Ser Phe Asn Asp Phe Ile Lys 1985 1990 1995			5994
gga act tac ctt gat ccg gcc gtc gca aac gag tac ccg tgc gtc Gly Thr Tyr Leu Asp Pro Ala Val Ala Asn Glu Tyr Pro Cys Val 2000 2005 2010			6039
gtt cag att aac aag cag atc ctt cgt gga gcg tgc ttc ttg cgc Val Gln Ile Asn Lys Gln Ile Leu Arg Gly Ala Cys Phe Leu Arg 2015 2020 2025			6084
cgt ctc gaa att ctg cgc aac gca cgc ctt tcc gat ggc gct gcc Arg Leu Glu Ile Leu Arg Asn Ala Arg Leu Ser Asp Gly Ala Ala 2030 2035 2040			6129
gct ctt gtg gcc agc atc gat gac aca tac gtc ccg gcc gag aag Ala Leu Val Ala Ser Ile Asp Asp Thr Tyr Val Pro Ala Glu Lys 2045 2050 2055			6174
ctg Leu			6177

<211> 2059  
 <212> PRT  
 <213> Schizochytrium sp.

<220>  
 <221> misc feature  
 <222> (370)..(370)  
 <223> The 'Xaa' at location 370 stands for Leu.

<220>  
 <221> misc feature  
 <222> (371)..(371)  
 <223> The 'Xaa' at location 371 stands for Ala, or Val.

<400> 4

Met Ala Ala Arg Asn Val Ser Ala Ala His Glu Met His Asp Glu Lys  
 1 5 10 15

Arg Ile Ala Val Val Gly Met Ala Val Gln Tyr Ala Gly Cys Lys Thr  
 20 25 30

Lys Asp Glu Phe Trp Glu Val Leu Met Asn Gly Lys Val Glu Ser Lys  
 35 40 45

Val Ile Ser Asp Lys Arg Leu Gly Ser Asn Tyr Arg Ala Glu His Tyr  
 50 55 60

Lys Ala Glu Arg Ser Lys Tyr Ala Asp Thr Phe Cys Asn Glu Thr Tyr  
 65 70 75 80

Gly Thr Leu Asp Glu Asn Glu Ile Asp Asn Glu His Glu Leu Leu Leu  
 85 90 95

Asn Leu Ala Lys Gln Ala Leu Ala Glu Thr Ser Val Lys Asp Ser Thr  
 100 105 110

Arg Cys Gly Ile Val Ser Gly Cys Leu Ser Phe Pro Met Asp Asn Leu  
 115 120 125

Gln Gly Glu Leu Leu Asn Val Tyr Gln Asn His Val Glu Lys Lys Leu  
 130 135 140

Gly Ala Arg Val Phe Lys Asp Ala Ser His Trp Ser Glu Arg Glu Gln  
 145 150 155 160

Ser Asn Lys Pro Glu Ala Gly Asp Arg Arg Ile Phe Met Asp Pro Ala  
 165 170 175

Ser Phe Val Ala Glu Glu Leu Asn Leu Gly Ala Leu His Tyr Ser Val  
 180 185 190

Asp Ala Ala Cys Ala Thr Ala Leu Tyr Val Leu Arg Leu Ala Gln Asp  
 195 200 205

His Leu Val Ser Gly Ala Ala Asp Val Met Leu Cys Gly Ala Thr Cys  
 210 215 220

Leu Pro Glu Pro Phe Phe Ile Leu Ser Gly Phe Ser Thr Phe Gln Ala  
 225 230 235 240

Met Pro Val Gly Thr Gly Gln Asn Val Ser Met Pro Leu His Lys Asp  
 245 250 255

Ser Gln Gly Leu Thr Pro Gly Glu Gly Gly Ser Ile Met Val Leu Lys  
 260 265 270

Arg Leu Asp Asp Ala Ile Arg Asp Gly Asp His Ile Tyr Gly Thr Leu  
 275 280 285

Leu Gly Ala Asn Val Ser Asn Ser Gly Thr Gly Leu Pro Leu Lys Pro  
 290 295 300

Leu Leu Pro Ser Glu Lys Lys Cys Leu Met Asp Thr Tyr Thr Arg Ile  
 305 310 315 320

Asn Val His Pro His Lys Ile Gln Tyr Val Glu Cys His Ala Thr Gly  
 325 330 335

Thr Pro Gln Gly Asp Arg Val Glu Ile Asp Ala Val Lys Ala Cys Phe  
 340 345 350

Glu Gly Lys Val Pro Arg Phe Gly Thr Thr Lys Gly Asn Phe Gly His  
 355 360 365

Thr Xaa Xaa Ala Ala Gly Phe Ala Gly Met Cys Lys Val Leu Leu Ser  
 370 375 380

Met Lys His Gly Ile Ile Pro Pro Thr Pro Gly Ile Asp Asp Glu Thr  
 385 390 395 400

Lys Met Asp Pro Leu Val Val Ser Gly Glu Ala Ile Pro Trp Pro Glu  
 405 410 415

Thr Asn Gly Glu Pro Lys Arg Ala Gly Leu Ser Ala Phe Gly Phe Gly  
 420 425 430

Gly Thr Asn Ala His Ala Val Phe Glu Glu His Asp Pro Ser Asn Ala  
 435 440 445

Ala Cys Thr Gly His Asp Ser Ile Ser Ala Leu Ser Ala Arg Cys Gly  
 450 455 460

Gly Glu Ser Asn Met Arg Ile Ala Ile Thr Gly Met Asp Ala Thr Phe  
 465 470 475 480

Gly Ala Leu Lys Gly Leu Asp Ala Phe Glu Arg Ala Ile Tyr Thr Gly  
485 490 495

Ala His Gly Ala Ile Pro Leu Pro Glu Lys Arg Trp Arg Phe Leu Gly  
500 505 510

Lys Asp Lys Asp Phe Leu Asp Leu Cys Gly Val Lys Ala Thr Pro His  
515 520 525

Gly Cys Tyr Ile Glu Asp Val Glu Val Asp Phe Gln Arg Leu Arg Thr  
530 535 540

Pro Met Thr Pro Glu Asp Met Leu Leu Pro Gln Gln Leu Leu Ala Val  
545 550 555 560

Thr Thr Ile Asp Arg Ala Ile Leu Asp Ser Gly Met Lys Lys Gly Gly  
565 570 575

Asn Val Ala Val Phe Val Gly Leu Gly Thr Asp Leu Glu Leu Tyr Arg  
580 585 590

His Arg Ala Arg Val Ala Leu Lys Glu Arg Val Arg Pro Glu Ala Ser  
595 600 605

Lys Lys Leu Asn Asp Met Met Gln Tyr Ile Asn Asp Cys Gly Thr Ser  
610 615 620

Thr Ser Tyr Thr Ser Tyr Ile Gly Asn Leu Val Ala Thr Arg Val Ser  
625 630 635 640

Ser Gln Trp Gly Phe Thr Gly Pro Ser Phe Thr Ile Thr Glu Gly Asn  
645 650 655

Asn Ser Val Tyr Arg Cys Ala Glu Leu Gly Lys Tyr Leu Leu Glu Thr  
660 665 670

Gly Glu Val Asp Gly Val Val Val Ala Gly Val Asp Leu Cys Gly Ser  
675 680 685

Ala Glu Asn Leu Tyr Val Lys Ser Arg Arg Phe Lys Val Ser Thr Ser  
690 695 700

Asp Thr Pro Arg Ala Ser Phe Asp Ala Ala Asp Gly Tyr Phe Val  
705 710 715 720

Gly Glu Gly Cys Gly Ala Phe Val Leu Lys Arg Glu Thr Ser Cys Thr  
725 730 735

Lys Asp Asp Arg Ile Tyr Ala Cys Met Asp Ala Ile Val Pro Gly Asn  
740 745 750

Val Pro Ser Ala Cys Leu Arg Glu Ala Leu Asp Gln Ala Arg Val Lys  
 755 760 765  
 Pro Gly Asp Ile Glu Met Leu Glu Leu Ser Ala Asp Ser Ala Arg His  
 770 775 780  
 Leu Lys Asp Pro Ser Val Leu Pro Lys Glu Leu Thr Ala Glu Glu Glu  
 785 790 795 800  
 Ile Gly Gly Leu Gln Thr Ile Leu Arg Asp Asp Asp Lys Leu Pro Arg  
 805 810 815  
 Asn Val Ala Thr Gly Ser Val Lys Ala Thr Val Gly Asp Thr Gly Tyr  
 820 825 830  
 Ala Ser Gly Ala Ala Ser Leu Ile Lys Ala Ala Leu Cys Ile Tyr Asn  
 835 840 845  
 Arg Tyr Leu Pro Ser Asn Gly Asp Asp Trp Asp Glu Pro Ala Pro Glu  
 850 855 860  
 Ala Pro Trp Asp Ser Thr Leu Phe Ala Cys Gln Thr Ser Arg Ala Trp  
 865 870 875 880  
 Leu Lys Asn Pro Gly Glu Arg Arg Tyr Ala Ala Val Ser Gly Val Ser  
 885 890 895  
 Glu Thr Arg Ser Cys Tyr Ser Val Leu Leu Ser Glu Ala Glu Gly His  
 900 905 910  
 Tyr Glu Arg Glu Asn Arg Ile Ser Leu Asp Glu Glu Ala Pro Lys Leu  
 915 920 925  
 Ile Val Leu Arg Ala Asp Ser His Glu Glu Ile Leu Gly Arg Leu Asp  
 930 935 940  
 Lys Ile Arg Glu Arg Phe Leu Gln Pro Thr Gly Ala Ala Pro Arg Glu  
 945 950 955 960  
 Ser Glu Leu Lys Ala Gln Ala Arg Arg Ile Phe Leu Glu Leu Leu Gly  
 965 970 975  
 Glu Thr Leu Ala Gln Asp Ala Ala Ser Ser Gly Ser Gln Lys Pro Leu  
 980 985 990  
 Ala Leu Ser Leu Val Ser Thr Pro Ser Lys Leu Gln Arg Glu Val Glu  
 995 1000 1005  
 Leu Ala Ala Lys Gly Ile Pro Arg Cys Leu Lys Met Arg Arg Asp  
 1010 1015 1020

Trp	Ser	Ser	Pro	Ala	Gly	Ser	Arg	Tyr	Ala	Pro	Glu	Pro	Leu	Ala
1025						1030					1035			
Ser	Asp	Arg	Val	Ala	Phe	Met	Tyr	Gly	Glu	Gly	Arg	Ser	Pro	Tyr
1040						1045					1050			
Tyr	Gly	Ile	Thr	Gln	Asp	Ile	His	Arg	Ile	Trp	Pro	Glu	Leu	His
1055						1060					1065			
Glu	Val	Ile	Asn	Glu	Lys	Thr	Asn	Arg	Leu	Trp	Ala	Glu	Gly	Asp
1070						1075					1080			
Arg	Trp	Val	Met	Pro	Arg	Ala	Ser	Phe	Lys	Ser	Glu	Leu	Glu	Ser
1085						1090					1095			
Gln	Gln	Gln	Glu	Phe	Asp	Arg	Asn	Met	Ile	Glu	Met	Phe	Arg	Leu
1100						1105					1110			
Gly	Ile	Leu	Thr	Ser	Ile	Ala	Phe	Thr	Asn	Leu	Ala	Arg	Asp	Val
1115						1120					1125			
Leu	Asn	Ile	Thr	Pro	Lys	Ala	Ala	Phe	Gly	Leu	Ser	Leu	Gly	Glu
1130						1135					1140			
Ile	Ser	Met	Ile	Phe	Ala	Phe	Ser	Lys	Lys	Asn	Gly	Leu	Ile	Ser
1145						1150					1155			
Asp	Gln	Leu	Thr	Lys	Asp	Leu	Arg	Glu	Ser	Asp	Val	Trp	Asn	Lys
1160						1165					1170			
Ala	Leu	Ala	Val	Glu	Phe	Asn	Ala	Leu	Arg	Glu	Ala	Trp	Gly	Ile
1175						1180					1185			
Pro	Gln	Ser	Val	Pro	Lys	Asp	Glu	Phe	Trp	Gln	Gly	Tyr	Ile	Val
1190						1195					1200			
Arg	Gly	Thr	Lys	Gln	Asp	Ile	Glu	Ala	Ala	Ile	Ala	Pro	Asp	Ser
1205						1210					1215			
Lys	Tyr	Val	Arg	Leu	Thr	Ile	Ile	Asn	Asp	Ala	Asn	Thr	Ala	Leu
1220						1225					1230			
Ile	Ser	Gly	Lys	Pro	Asp	Ala	Cys	Lys	Ala	Ala	Ile	Ala	Arg	Leu
1235						1240					1245			
Gly	Gly	Asn	Ile	Pro	Ala	Leu	Pro	Val	Thr	Gln	Gly	Met	Cys	Gly
1250						1255					1260			
His	Cys	Pro	Glu	Val	Gly	Pro	Tyr	Thr	Lys	Asp	Ile	Ala	Lys	Ile
1265						1270					1275			



His Ala	Asn Leu Glu Phe	Pro	Val Val Asp Gly	Leu	Asp Leu Trp
1280		1285		1290	
Thr Thr	Ile Asn Gln Lys	Arg	Leu Val Pro Arg	Ala	Thr Gly Ala
1295		1300		1305	
Lys Asp	Glu Trp Ala Pro	Ser	Ser Phe Gly Glu	Tyr	Ala Gly Gln
1310		1315		1320	
Leu Tyr	Glu Lys Gln Ala	Asn	Phe Pro Gln Ile	Val	Glu Thr Ile
1325		1330		1335	
Tyr Lys	Gln Asn Tyr Asp	Val	Phe Val Glu Val	Gly	Pro Asn Asn
1340		1345		1350	
His Arg	Ser Thr Ala Val	Arg	Thr Thr Leu Gly	Pro	Gln Arg Asn
1355		1360		1365	
His Leu	Ala Gly Ala Ile	Asp	Lys Gln Asn Glu	Asp	Ala Trp Thr
1370		1375		1380	
Thr Ile	Val Lys Leu Val	Ala	Ser Leu Lys Ala	His	Leu Val Pro
1385		1390		1395	
Gly Val	Thr Ile Ser Pro	Leu	Tyr His Ser Lys	Leu	Val Ala Glu
1400		1405		1410	
Ala Gln	Ala Cys Tyr Ala	Ala	Leu Cys Lys Gly	Glu	Lys Pro Lys
1415		1420		1425	
Lys Asn	Lys Phe Val Arg	Lys	Ile Gln Leu Asn	Gly	Arg Phe Asn
1430		1435		1440	
Ser Lys	Ala Asp Pro Ile	Ser	Ser Ala Asp Leu	Ala	Ser Phe Pro
1445		1450		1455	
Pro Ala	Asp Pro Ala Ile	Glu	Ala Ala Ile Ser	Ser	Arg Ile Met
1460		1465		1470	
Lys Pro	Val Ala Pro Lys	Phe	Tyr Ala Arg Leu	Asn	Ile Asp Glu
1475		1480		1485	
Gln Asp	Glu Thr Arg Asp	Pro	Ile Leu Asn Lys	Asp	Asn Ala Pro
1490		1495		1500	
Ser Ser	Ser Ser Ser Ser	Ser	Ser Ser Ser Ser	Ser	Ser Ser Ser
1505		1510		1515	
Pro Ser	Pro Ala Pro Ser	Ala	Pro Val Gln Lys	Lys	Ala Ala Pro
1520		1525		1530	

Ala	Ala	Glu	Thr	Lys	Ala	Val	Ala	Ser	Ala	Asp	Ala	Leu	Arg	Ser
1535						1540					1545			
Ala	Leu	Leu	Asp	Leu	Asp	Ser	Met	Leu	Ala	Leu	Ser	Ser	Ala	Ser
1550						1555					1560			
Ala	Ser	Gly	Asn	Leu	Val	Glu	Thr	Ala	Pro	Ser	Asp	Ala	Ser	Val
1565						1570					1575			
Ile	Val	Pro	Pro	Cys	Asn	Ile	Ala	Asp	Leu	Gly	Ser	Arg	Ala	Phe
1580						1585					1590			
Met	Lys	Thr	Tyr	Gly	Val	Ser	Ala	Pro	Leu	Tyr	Thr	Gly	Ala	Met
1595						1600					1605			
Ala	Lys	Gly	Ile	Ala	Ser	Ala	Asp	Leu	Val	Ile	Ala	Ala	Gly	Arg
1610						1615					1620			
Gln	Gly	Ile	Leu	Ala	Ser	Phe	Gly	Ala	Gly	Gly	Leu	Pro	Met	Gln
1625						1630					1635			
Val	Val	Arg	Glu	Ser	Ile	Glu	Lys	Ile	Gln	Ala	Ala	Leu	Pro	Asn
1640						1645					1650			
Gly	Pro	Tyr	Ala	Val	Asn	Leu	Ile	His	Ser	Pro	Phe	Asp	Ser	Asn
1655						1660					1665			
Leu	Glu	Lys	Gly	Asn	Val	Asp	Leu	Phe	Leu	Glu	Lys	Gly	Val	Thr
1670						1675					1680			
Phe	Val	Glu	Ala	Ser	Ala	Phe	Met	Thr	Leu	Thr	Pro	Gln	Val	Val
1685						1690					1695			
Arg	Tyr	Arg	Ala	Ala	Gly	Leu	Thr	Arg	Asn	Ala	Asp	Gly	Ser	Val
1700						1705					1710			
Asn	Ile	Arg	Asn	Arg	Ile	Ile	Gly	Lys	Val	Ser	Arg	Thr	Glu	Leu
1715						1720					1725			
Ala	Glu	Met	Phe	Met	Arg	Pro	Ala	Pro	Glu	His	Leu	Leu	Gln	Lys
1730						1735					1740			
Leu	Ile	Ala	Ser	Gly	Glu	Ile	Asn	Gln	Glu	Gln	Ala	Glu	Leu	Ala
1745						1750					1755			
Arg	Arg	Val	Pro	Val	Ala	Asp	Asp	Ile	Ala	Val	Glu	Ala	Asp	Ser
1760						1765					1770			
Gly	Gly	His	Thr	Asp	Asn	Arg	Pro	Ile	His	Val	Ile	Leu	Pro	Leu
1775						1780					1785			

Ile	Ile	Asn	Leu	Arg	Asp	Arg	Leu	His	Arg	Glu	Cys	Gly	Tyr	Pro
1790						1795					1800			
Ala	Asn	Leu	Arg	Val	Arg	Val	Gly	Ala	Gly	Gly	Gly	Ile	Gly	Cys
1805						1810					1815			
Pro	Gln	Ala	Ala	Leu	Ala	Thr	Phe	Asn	Met	Gly	Ala	Ser	Phe	Ile
1820						1825					1830			
Val	Thr	Gly	Thr	Val	Asn	Gln	Val	Ala	Lys	Gln	Ser	Gly	Thr	Cys
1835						1840					1845			
Asp	Asn	Val	Arg	Lys	Gln	Leu	Ala	Lys	Ala	Thr	Tyr	Ser	Asp	Val
1850						1855					1860			
Cys	Met	Ala	Pro	Ala	Ala	Asp	Met	Phe	Glu	Glu	Gly	Val	Lys	Leu
1865						1870					1875			
Gln	Val	Leu	Lys	Lys	Gly	Thr	Met	Phe	Pro	Ser	Arg	Ala	Asn	Lys
1880						1885					1890			
Leu	Tyr	Glu	Leu	Phe	Cys	Lys	Tyr	Asp	Ser	Phe	Glu	Ser	Met	Pro
1895						1900					1905			
Pro	Ala	Glu	Leu	Ala	Arg	Val	Glu	Lys	Arg	Ile	Phe	Ser	Arg	Ala
1910						1915					1920			
Leu	Glu	Glu	Val	Trp	Asp	Glu	Thr	Lys	Asn	Phe	Tyr	Ile	Asn	Arg
1925						1930					1935			
Leu	His	Asn	Pro	Glu	Lys	Ile	Gln	Arg	Ala	Glu	Arg	Asp	Pro	Lys
1940						1945					1950			
Leu	Lys	Met	Ser	Leu	Cys	Phe	Arg	Trp	Tyr	Leu	Ser	Leu	Ala	Ser
1955						1960					1965			
Arg	Trp	Ala	Asn	Thr	Gly	Ala	Ser	Asp	Arg	Val	Met	Asp	Tyr	Gln
1970						1975					1980			
Val	Trp	Cys	Gly	Pro	Ala	Ile	Gly	Ser	Phe	Asn	Asp	Phe	Ile	Lys
1985						1990					1995			
Gly	Thr	Tyr	Leu	Asp	Pro	Ala	Val	Ala	Asn	Glu	Tyr	Pro	Cys	Val
2000						2005					2010			
Val	Gln	Ile	Asn	Lys	Gln	Ile	Leu	Arg	Gly	Ala	Cys	Phe	Leu	Arg
2015						2020					2025			
Arg	Leu	Glu	Ile	Leu	Arg	Asn	Ala	Arg	Leu	Ser	Asp	Gly	Ala	Ala
2030						2035					2040			

Ala Leu Val Ala Ser Ile Asp Asp Thr Tyr Val Pro Ala Glu Lys  
 2045 2050 2055

Leu

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 aag gag gag ctg acc agc ggc aag acc gag gtg ttc aac tat gag gaa 96  
 Lys Glu Glu Leu Thr Ser Gly Lys Thr Glu Val Phe Asn Tyr Glu Glu  
 20 25 30  
 ctc ctc gag ttc gca gag ggc gac atc gcc aag gtc ttc gga ccc gag 144  
 Leu Leu Glu Phe Ala Glu Gly Asp Ile Ala Lys Val Phe Gly Pro Glu  
 35 40 45  
 ttc gcc gtc atc gac aag tac ccg cgc cgc gtg cgc ctg ccc gcc cgc 192  
 Phe Ala Val Ile Asp Lys Tyr Pro Arg Arg Val Arg Leu Pro Ala Arg  
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 gag tac ctg ctc gtg acc cgc gtc acc ctc atg gac gcc gag gtc aac 240  
 Glu Tyr Leu Leu Val Thr Arg Val Thr Leu Met Asp Ala Glu Val Asn  
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 aac tac cgc gtc ggc gcc cgc atg gtc acc gag tac gat ctc ccc gtc 288  
 Asn Tyr Arg Val Gly Ala Arg Met Val Thr Glu Tyr Asp Leu Pro Val  
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 aac gga gag ctc tcc gag ggc gga gac tgc ccc tgg gcc gtc ctg gtc 336  
 Asn Gly Glu Leu Ser Glu Gly Gly Asp Cys Pro Trp Ala Val Leu Val  
 100 105 110  
 gag agt ggc cag tgc gat ctc atg ctc atc tcc tac atg ggc att gac 384  
 Glu Ser Gly Gln Cys Asp Leu Met Leu Ile Ser Tyr Met Gly Ile Asp  
 115 120 125  
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 Phe Gln Asn Gln Gly Asp Arg Val Tyr Arg Leu Leu Asn Thr Thr Leu  
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 Thr Phe Tyr Gly Val Ala His Glu Gly Glu Thr Leu Glu Tyr Asp Ile  
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 Arg Val Thr Gly Phe Ala Lys Arg Leu Asp Gly Gly Ile Ser Met Phe  
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 Phe Phe Glu Tyr Asp Cys Tyr Val Asn Gly Arg Leu Leu Ile Glu Met  
 180 185 190  
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Arg	Asp	Gly	Cys	Ala	Gly	Phe	Phe	Thr	Asn	Glu	Glu	Leu	Asp	Ala	Gly	
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aag	ggc	gtc	gtc	ttc	acc	cgc	ggc	gac	ctc	gcc	gcc	cgc	gcc	aag	atc	672
Lys	Gly	Val	Val	Phe	Thr	Arg	Gly	Asp	Leu	Ala	Ala	Arg	Ala	Lys	Ile	
		210				215					220					
cca	aag	cag	gac	gtc	tcc	ccc	tac	gcc	gtc	gcc	ccc	tgc	ctc	cac	aag	720
Pro	Lys	Gln	Asp	Val	Ser	Pro	Tyr	Ala	Val	Ala	Pro	Cys	Leu	His	Lys	
					230					235					240	
acc	aag	ctc	aac	gaa	aag	gag	atg	cag	acc	ctc	gtc	gac	aag	gac	tgg	768
Thr	Lys	Leu	Asn	Glu	Lys	Glu	Met	Gln	Thr	Leu	Val	Asp	Lys	Asp	Trp	
				245				250						255		
gca	tcc	gtc	ttt	ggc	tcc	aag	aac	ggc	atg	cgc	gaa	atc	aac	tac	aaa	816
Ala	Ser	Val	Phe	Gly	Ser	Lys	Asn	Gly	Met	Pro	Glu	Ile	Asn	Tyr	Lys	
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ctc	tgc	gcg	cgt	aag	atg	ctc	atg	att	gac	cgc	gtc	acc	agc	att	gac	864
Leu	Cys	Ala	Arg	Lys	Met	Leu	Met	Ile	Asp	Arg	Val	Thr	Ser	Ile	Asp	
		275					280					285				
cac	aag	ggc	ggg	gtc	tac	ggc	ctc	ggg	cag	ctc	gtc	ggg	gaa	aag	atc	912
His	Lys	Gly	Gly	Val	Tyr	Gly	Leu	Gly	Gln	Leu	Val	Gly	Glu	Lys	Ile	
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ctc	gag	cgc	gac	cac	tgg	tac	ttt	ccc	tgc	cac	ttt	gtc	aag	gat	cag	960
Leu	Glu	Arg	Asp	His	Trp	Tyr	Phe	Pro	Cys	His	Phe	Val	Lys	Asp	Gln	
					310					315					320	
gtc	atg	gcc	gga	tcc	ctc	gtc	tcc	gac	ggc	tgc	agc	cag	atg	ctc	aag	1008
Val	Met	Ala	Gly	Ser	Leu	Val	Ser	Asp	Gly	Cys	Ser	Gln	Met	Leu	Lys	
				325					330					335		
atg	tac	atg	atc	tgg	ctc	ggc	ctc	cac	ctc	acc	acc	gga	ccc	ttt	gac	1056
Met	Tyr	Met	Ile	Trp	Leu	Gly	Leu	His	Leu	Thr	Thr	Gly	Pro	Phe	Asp	
			340					345					350			
ttc	cgc	ccg	gtc	aac	ggc	cac	ccc	aac	aag	gtc	cgc	tgc	cgc	ggc	caa	1104
Phe	Arg	Pro	Val	Asn	Gly	His	Pro	Asn	Lys	Val	Arg	Cys	Arg	Gly	Gln	
		355					360					365				
atc	tcc	ccg	cac	aag	ggc	aag	ctc	gtc	tac	gtc	atg	gag	atc	aag	gag	1152
Ile	Ser	Pro	His	Lys	Gly	Lys	Leu	Val	Tyr	Val	Met	Glu	Ile	Lys	Glu	
		370				375					380					
atg	ggc	ttc	gac	gag	gac	aac	gac	ccg	tac	gcc	att	gcc	gac	gtc	aac	1200
Met	Gly	Phe	Asp	Glu	Asp	Asn	Asp	Pro	Tyr	Ala	Ile	Ala	Asp	Val	Asn	
					390					395					400	
atc	att	gat	gtc	gac	ttc	gaa	aag	ggc	cag	gac	ttt	agc	ctc	gac	cgc	1248
Ile	Ile	Asp	Val	Asp	Phe	Glu	Lys	Gly	Gln	Asp	Phe	Ser	Leu	Asp	Arg	
				405					410					415		
atc	agc	gac	tac	ggc	aag	ggc	gac	ctc	aac	aag	aag	atc	gtc	gtc	gac	1296
Ile	Ser	Asp	Tyr	Gly	Lys	Gly	Asp	Leu	Asn	Lys	Lys	Ile	Val	Val	Asp	
			420					425					430			
ttt	aag	ggc	atc	gct	ctc	aag	atg	cag	aag	cgc	tcc	acc	aac	aag	aac	1344
Phe	Lys	Gly	Ile	Ala	Leu	Lys	Met	Gln	Lys	Arg	Ser	Thr	Asn	Lys	Asn	
		435					440					445				
ccc	tcc	aag	gtt	cag	ccc	gtc	ttt	gcc	aac	ggc	gcc	gcc	act	gtc	ggc	1392
Pro	Ser	Lys	Val	Gln	Pro	Val	Phe	Ala	Asn	Gly	Ala	Ala	Thr	Val	Gly	
		450				455					460					
ccc	gag	gcc	tcc	aag	gct	tcc	tcc	ggc	gcc	agc	gcc	agc	gcc	agc	gcc	1440

Pro Glu Ala Ser Lys Ala Ser Ser Gly Ala Ser Ala Ser Ala Ser Ala	465	470	475	480	
gcc ccg gcc aag cct gcc ttc agc gcc gat gtt ctt gcg ccc aag ccc	1488				
Ala Pro Ala Lys Pro Ala Phe Ser Ala Asp Val Leu Ala Pro Lys Pro		485	490	495	
gtt gcc ctt ccc gag cac atc ctc aag ggc gac gcc ctc gcc ccc aag	1536				
Val Ala Leu Pro Glu His Ile Leu Lys Gly Asp Ala Leu Ala Pro Lys		500	505	510	
gag atg tcc tgg cac ccc atg gcc cgc atc ccg ggc aac ccg acg ccc	1584				
Glu Met Ser Trp His Pro Met Ala Arg Ile Pro Gly Asn Pro Thr Pro		515	520	525	
tct ttt gcg ccc tcg gcc tac aag ccg cgc aac atc gcc ttt acg ccc	1632				
Ser Phe Ala Pro Ser Ala Tyr Lys Pro Arg Asn Ile Ala Phe Thr Pro		530	535	540	
ttc ccc ggc aac ccc aac gat aac gac cac acc ccg ggc aag atg ccg	1680				
Phe Pro Gly Asn Pro Asn Asp Asn Asp His Thr Pro Gly Lys Met Pro		545	550	555	560
ctc acc tgg ttc aac atg gcc gag ttc atg gcc ggc aag gtc agc atg	1728				
Leu Thr Trp Phe Asn Met Ala Glu Phe Met Ala Gly Lys Val Ser Met		565	570	575	
tgc ctc ggc ccc gag ttc gcc aag ttc gac gac tcg aac acc agc cgc	1776				
Cys Leu Gly Pro Glu Phe Ala Lys Phe Asp Asp Ser Asn Thr Ser Arg		580	585	590	
agc ccc gct tgg gac ctc gct ctc gtc acc cgc gcc gtg tct gtg tct	1824				
Ser Pro Ala Trp Asp Leu Ala Leu Val Thr Arg Ala Val Ser Val Ser		595	600	605	
gac ctc aag cac gtc aac tac cgc aac atc gac ctc gac ccc tcc aag	1872				
Asp Leu Lys His Val Asn Tyr Arg Asn Ile Asp Leu Asp Pro Ser Lys		610	615	620	
ggt acc atg gtc ggc gag ttc gac tgc ccc gcg gac gcc tgg ttc tac	1920				
Gly Thr Met Val Gly Glu Phe Asp Cys Pro Ala Asp Ala Trp Phe Tyr		625	630	635	640
aag ggc gcc tgc aac gat gcc cac atg ccg tac tcg atc ctc atg gag	1968				
Lys Gly Ala Cys Asn Asp Ala His Met Pro Tyr Ser Ile Leu Met Glu		645	650	655	
atc gcc ctc cag acc tcg ggt gtg ctc acc tcg gtg ctc aag gcg ccc	2016				
Ile Ala Leu Gln Thr Ser Gly Val Leu Thr Ser Val Leu Lys Ala Pro		660	665	670	
ctg acc atg gag aag gac gac atc ctc ttc cgc aac ctc gac gcc aac	2064				
Leu Thr Met Glu Lys Asp Asp Ile Leu Phe Arg Asn Leu Asp Ala Asn		675	680	685	
gcc gag ttc gtg cgc gcc gac ctc gac tac cgc ggc aag act atc cgc	2112				
Ala Glu Phe Val Arg Ala Asp Leu Asp Tyr Arg Gly Lys Thr Ile Arg		690	695	700	
aac gtc acc aag tgc act ggc tac agc atg ctc ggc gag atg ggc gtc	2160				
Asn Val Thr Lys Cys Thr Gly Tyr Ser Met Leu Gly Glu Met Gly Val		705	710	715	720
cac cgc ttc acc ttt gag ctc tac gtc gat gat gtg ctc ttt tac aag	2208				
His Arg Phe Thr Phe Glu Leu Tyr Val Asp Asp Val Leu Phe Tyr Lys		725	730	735	
ggc tcg acc tcg ttc ggc tgg ttc gtg ccc gag gtc ttt gcc gcc cag	2256				

Gly	Ser	Thr	Ser	Phe	Gly	Trp	Phe	Val	Pro	Glu	Val	Phe	Ala	Ala	Gln		
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gcc	ggc	ctc	gac	aac	ggc	cgc	aag	tcg	gag	ccc	tgg	ttc	att	gag	aac	2304	
Ala	Gly	Leu	Asp	Asn	Gly	Arg	Lys	Ser	Glu	Pro	Trp	Phe	Ile	Glu	Asn		
		755					760					765					
aag	gtt	ccg	gcc	tcg	cag	gtc	tcc	tcc	ttt	gac	gtg	cgc	ccc	aac	ggc	2352	
Lys	Val	Pro	Ala	Ser	Gln	Val	Ser	Ser	Phe	Asp	Val	Arg	Pro	Asn	Gly		
	770					775					780						
agc	ggc	cgc	acc	gcc	atc	ttc	gcc	aac	ggc	ccc	agc	ggc	gcc	cag	ctc	2400	
Ser	Gly	Arg	Thr	Ala	Ile	Phe	Ala	Asn	Ala	Pro	Ser	Gly	Ala	Gln	Leu		
785					790					795					800		
aac	cgc	cgc	acg	gac	cag	ggc	cag	tac	ctc	gac	gcc	gtc	gac	att	gtc	2448	
Asn	Arg	Arg	Thr	Asp	Gln	Gly	Gln	Tyr	Leu	Asp	Ala	Val	Asp	Ile	Val		
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tcc	ggc	agc	ggc	aag	aag	agc	ctc	ggc	tac	gcc	cac	ggg	tcc	aag	acg	2496	
Ser	Gly	Ser	Gly	Lys	Lys	Ser	Leu	Gly	Tyr	Ala	His	Gly	Ser	Lys	Thr		
			820					825					830				
gtc	aac	ccg	aac	gac	tgg	ttc	ttc	tcg	tgc	cac	ttt	tgg	ttt	gac	tcg	2544	
Val	Asn	Pro	Asn	Asp	Trp	Phe	Phe	Ser	Cys	His	Phe	Trp	Phe	Asp	Ser		
		835					840					845					
gtc	atg	ccc	gga	agt	ctc	ggg	gtc	gag	tcc	atg	ttc	cag	ctc	gtc	gag	2592	
Val	Met	Pro	Gly	Ser	Leu	Gly	Val	Glu	Ser	Met	Phe	Gln	Leu	Val	Glu		
	850					855					860						
gcc	atc	gcc	gcc	cac	gag	gat	ctc	gct	ggc	aaa	gca	cgg	cat	tgc	caa	2640	
Ala	Ile	Ala	Ala	His	Glu	Asp	Leu	Ala	Gly	Lys	Ala	Arg	His	Cys	Gln		
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ccc	cac	ctt	tgt	gca	cgc	ccc	cgg	gca	aga	tca	agc	tgg	aag	tac	cgc	2688	
Pro	His	Leu	Cys	Ala	Arg	Pro	Arg	Ala	Arg	Ser	Ser	Trp	Lys	Tyr	Arg		
				885					890					895			
ggc	cag	ctc	acg	ccc	aag	agc	aag	aag	atg	gac	tcg	gag	gtc	cac	atc	2736	
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Val	Ser	Val	Asp	Ala	His	Asp	Gly	Val	Val	Asp	Leu	Val	Ala	Asp	Gly		
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Phe	Leu	Trp	Ala	Asp	Ser	Leu	Arg	Val	Tyr	Ser	Val	Ser	Asn	Ile	Arg		
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gtg	cgc	atc	gcc	tcc	ggg	gag	gcc	cct	gcc	gcc	gcc	tcc	tcc	gcc	gcc	2880	
Val	Arg	Ile	Ala	Ser	Gly	Glu	Ala	Pro	Ala	Ala	Ala	Ser	Ser	Ala	Ala		
945					950					955					960		
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Ser	Val	Gly	Ser	Ser	Ala	Ser	Ser	Val	Glu	Arg	Thr	Arg	Ser	Ser	Pro		
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gct	gtc	gcc	tcc	ggc	ccg	gcc	cag	acc	atc	gac	ctc	aag	cag	ctc	aag	2976	
Ala	Val	Ala	Ser	Gly	Pro	Ala	Gln	Thr	Ile	Asp	Leu	Lys	Gln	Leu	Lys		
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acc	gag	ctc	ctc	gag	ctc	gat	gcc	ccg	ctc	tac	ctc	tcg	cag	gac	ccg	3024	
Thr	Glu	Leu	Leu	Glu	Leu	Asp	Ala	Pro	Leu	Tyr	Leu	Ser	Gln	Asp	Pro		
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Thr	Ser	Gly	Gln	Leu	Lys	Lys	His	Thr	Asp	Val	Ala	Ser	Gly	Gln	
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Ala	Thr	Ile	Val	Gln	Pro	Cys	Thr	Leu	Gly	Asp	Leu	Gly	Asp	Arg	
1025						1030					1035				
tcc	ttc	atg	gag	acc	tac	ggc	gtc	gtc	ggc	ccg	ctg	tac	acg	ggc	3159
Ser	Phe	Met	Glu	Thr	Tyr	Gly	Val	Val	Ala	Pro	Leu	Tyr	Thr	Gly	
1040						1045					1050				
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Ala	Met	Ala	Lys	Gly	Ile	Ala	Ser	Ala	Asp	Leu	Val	Ile	Ala	Ala	
1055						1060					1065				
ggc	aag	cgc	aag	atc	ctc	ggc	tcc	ttt	ggc	ggc	ggc	ggc	ctc	ccc	3249
Gly	Lys	Arg	Lys	Ile	Leu	Gly	Ser	Phe	Gly	Ala	Gly	Gly	Leu	Pro	
1070						1075					1080				
atg	cac	cac	gtg	cgc	gcc	gcc	ctc	gag	aag	atc	cag	gcc	gcc	ctg	3294
Met	His	His	Val	Arg	Ala	Ala	Leu	Glu	Lys	Ile	Gln	Ala	Ala	Leu	
1085						1090					1095				
cct	cag	ggc	ccc	tac	gcc	gtc	aac	ctc	atc	cac	tgc	cct	ttt	gac	3339
Pro	Gln	Gly	Pro	Tyr	Ala	Val	Asn	Leu	Ile	His	Ser	Pro	Phe	Asp	
1100						1105					1110				
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Ser	Asn	Leu	Glu	Lys	Gly	Asn	Val	Asp	Leu	Phe	Leu	Glu	Lys	Gly	
1115						1120					1125				
gtc	act	gtg	gtg	gag	gcc	tgc	gca	ttc	atg	acc	ctc	acc	ccg	cag	3429
Val	Thr	Val	Val	Glu	Ala	Ser	Ala	Phe	Met	Thr	Leu	Thr	Pro	Gln	
1130						1135					1140				
gtc	gtg	cgc	tac	cgc	gcc	gcc	ggc	ctc	tgc	cgc	aac	gcc	gac	ggg	3474
Val	Val	Arg	Tyr	Arg	Ala	Ala	Gly	Leu	Ser	Arg	Asn	Ala	Asp	Gly	
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Ser	Val	Asn	Ile	Arg	Asn	Arg	Ile	Ile	Gly	Lys	Val	Ser	Arg	Thr	
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Glu	Leu	Ala	Glu	Met	Phe	Ile	Arg	Pro	Ala	Pro	Glu	His	Leu	Leu	
1175						1180					1185				
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1190						1195					1200				
ctc	gcg	cgc	cgc	gtt	ccc	gtc	gcc	gac	gat	atc	gct	gtc	gag	gct	3654
Leu	Ala	Arg	Arg	Val	Pro	Val	Ala	Asp	Asp	Ile	Ala	Val	Glu	Ala	
1205						1210					1215				
gac	tgc	ggc	ggc	cac	acc	gac	aac	cgc	ccc	atc	cac	gtc	atc	ctc	3699
Asp	Ser	Gly	Gly	His	Thr	Asp	Asn	Arg	Pro	Ile	His	Val	Ile	Leu	
1220						1225					1230				
ccg	ctc	atc	atc	aac	ctc	cgc	aac	cgc	ctg	cac	cgc	gag	tgc	ggc	3744
Pro	Leu	Ile	Ile	Asn	Leu	Arg	Asn	Arg	Leu	His	Arg	Glu	Cys	Gly	
1235						1240					1245				
tac	ccc	gcg	cac	ctc	cgc	gtc	cgc	gtt	ggc	ggc	ggc	ggg	ggc	gtc	3789
Tyr	Pro	Ala	His	Leu	Arg	Val	Arg	Val	Gly	Ala	Gly	Gly	Gly	Val	
1250						1255					1260				
ggc	tgc	ccg	cag	gcc	gcc	gcc	gcc	gcg	ctc	acc	atg	ggc	gcc	gcc	3834



Gly	Cys	Pro	Gln	Ala	Ala	Ala	Ala	Ala	Leu	Thr	Met	Gly	Ala	Ala	
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Phe	Ile	Val	Thr	Gly	Thr	Val	Asn	Gln	Val	Ala	Lys	Gln	Ser	Gly	
1280						1285					1290				
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Thr	Cys	Asp	Asn	Val	Arg	Lys	Gln	Leu	Ser	Gln	Ala	Thr	Tyr	Ser	
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gat	atc	tgc	atg	gcc	ccg	gcc	gcc	gac	atg	ttc	gag	gag	ggc	gtc	3969
Asp	Ile	Cys	Met	Ala	Pro	Ala	Ala	Asp	Met	Phe	Glu	Glu	Gly	Val	
1310						1315					1320				
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Lys	Leu	Gln	Val	Leu	Lys	Lys	Gly	Thr	Met	Phe	Pro	Ser	Arg	Ala	
1325						1330					1335				
aac	aag	ctc	tac	gag	ctc	ttt	tgc	aag	tac	gac	tcc	ttc	gac	tcc	4059
Asn	Lys	Leu	Tyr	Glu	Leu	Phe	Cys	Lys	Tyr	Asp	Ser	Phe	Asp	Ser	
1340						1345					1350				
atg	cct	cct	gcc	gag	ctc	gag	cgc	atc	gag	aag	cgt	atc	ttc	aag	4104
Met	Pro	Pro	Ala	Glu	Leu	Glu	Arg	Ile	Glu	Lys	Arg	Ile	Phe	Lys	
1355						1360					1365				
cgc	gca	ctc	cag	gag	gtc	tgg	gag	gag	acc	aag	gac	ttt	tac	att	4149
Arg	Ala	Leu	Gln	Glu	Val	Trp	Glu	Glu	Thr	Lys	Asp	Phe	Tyr	Ile	
1370						1375					1380				
aac	ggt	ctc	aag	aac	ccg	gag	aag	atc	cag	cgc	gcc	gag	cac	gac	4194
Asn	Gly	Leu	Lys	Asn	Pro	Glu	Lys	Ile	Gln	Arg	Ala	Glu	His	Asp	
1385						1390					1395				
ccc	aag	ctc	aag	atg	tcg	ctc	tgc	ttc	cgc	tgg	tac	ctt	ggt	ctt	4239
Pro	Lys	Leu	Lys	Met	Ser	Leu	Cys	Phe	Arg	Trp	Tyr	Leu	Gly	Leu	
1400						1405					1410				
gcc	agc	cgc	tgg	gcc	aac	atg	ggc	gcc	ccg	gac	cgc	gtc	atg	gac	4284
Ala	Ser	Arg	Trp	Ala	Asn	Met	Gly	Ala	Pro	Asp	Arg	Val	Met	Asp	
1415						1420					1425				
tac	cag	gtc	tgg	tgt	ggc	ccg	gcc	att	ggc	gcc	ttc	aac	gac	ttc	4329
Tyr	Gln	Val	Trp	Cys	Gly	Pro	Ala	Ile	Gly	Ala	Phe	Asn	Asp	Phe	
1430						1435					1440				
atc	aag	ggc	acc	tac	ctc	gac	ccc	gct	gtc	tcc	aac	gag	tac	ccc	4374
Ile	Lys	Gly	Thr	Tyr	Leu	Asp	Pro	Ala	Val	Ser	Asn	Glu	Tyr	Pro	
1445						1450					1455				
tgt	gtc	gtc	cag	atc	aac	ctg	caa	atc	ctc	cgt	ggt	gcc	tgc	tac	4419
Cys	Val	Val	Gln	Ile	Asn	Leu	Gln	Ile	Leu	Arg	Gly	Ala	Cys	Tyr	
1460						1465					1470				
ctg	cgc	cgt	ctc	aac	gcc	ctg	cgc	aac	gac	ccg	cgc	att	gac	ctc	4464
Leu	Arg	Arg	Leu	Asn	Ala	Leu	Arg	Asn	Asp	Pro	Arg	Ile	Asp	Leu	
1475						1480					1485				
gag	acc	gag	gat	gct	gcc	ttt	gtc	tac	gag	ccc	acc	aac	gcg	ctc	4509
Glu	Thr	Glu	Asp	Ala	Ala	Phe	Val	Tyr	Glu	Pro	Thr	Asn	Ala	Leu	
1490						1495					1500				

<210> 6  
 <211> 1503  
 <212> PRT  
 <213> Schizochytrium sp.

<400> 6

Met Ala Leu Arg Val Lys Thr Asn Lys Lys Pro Cys Trp Glu Met Thr  
1 5 10 15

Lys Glu Glu Leu Thr Ser Gly Lys Thr Glu Val Phe Asn Tyr Glu Glu  
20 25 30

Leu Leu Glu Phe Ala Glu Gly Asp Ile Ala Lys Val Phe Gly Pro Glu  
35 40 45

Phe Ala Val Ile Asp Lys Tyr Pro Arg Arg Val Arg Leu Pro Ala Arg  
50 55 60

Glu Tyr Leu Leu Val Thr Arg Val Thr Leu Met Asp Ala Glu Val Asn  
65 70 75 80

Asn Tyr Arg Val Gly Ala Arg Met Val Thr Glu Tyr Asp Leu Pro Val  
85 90 95

Asn Gly Glu Leu Ser Glu Gly Gly Asp Cys Pro Trp Ala Val Leu Val  
100 105 110

Glu Ser Gly Gln Cys Asp Leu Met Leu Ile Ser Tyr Met Gly Ile Asp  
115 120 125

Phe Gln Asn Gln Gly Asp Arg Val Tyr Arg Leu Leu Asn Thr Thr Leu  
130 135 140

Thr Phe Tyr Gly Val Ala His Glu Gly Glu Thr Leu Glu Tyr Asp Ile  
145 150 155 160

Arg Val Thr Gly Phe Ala Lys Arg Leu Asp Gly Gly Ile Ser Met Phe  
165 170 175

Phe Phe Glu Tyr Asp Cys Tyr Val Asn Gly Arg Leu Leu Ile Glu Met  
180 185 190

Arg Asp Gly Cys Ala Gly Phe Phe Thr Asn Glu Glu Leu Asp Ala Gly  
195 200 205

Lys Gly Val Val Phe Thr Arg Gly Asp Leu Ala Ala Arg Ala Lys Ile  
210 215 220

Pro Lys Gln Asp Val Ser Pro Tyr Ala Val Ala Pro Cys Leu His Lys  
225 230 235 240

Thr Lys Leu Asn Glu Lys Glu Met Gln Thr Leu Val Asp Lys Asp Trp  
245 250 255

Ala Ser Val Phe Gly Ser Lys Asn Gly Met Pro Glu Ile Asn Tyr Lys  
260 265 270

Leu Cys Ala Arg Lys Met Leu Met Ile Asp Arg Val Thr Ser Ile Asp  
 275 280 285

His Lys Gly Gly Val Tyr Gly Leu Gly Gln Leu Val Gly Glu Lys Ile  
 290 295 300

Leu Glu Arg Asp His Trp Tyr Phe Pro Cys His Phe Val Lys Asp Gln  
 305 310 315 320

Val Met Ala Gly Ser Leu Val Ser Asp Gly Cys Ser Gln Met Leu Lys  
 325 330 335

Met Tyr Met Ile Trp Leu Gly Leu His Leu Thr Thr Gly Pro Phe Asp  
 340 345 350

Phe Arg Pro Val Asn Gly His Pro Asn Lys Val Arg Cys Arg Gly Gln  
 355 360 365

Ile Ser Pro His Lys Gly Lys Leu Val Tyr Val Met Glu Ile Lys Glu  
 370 375 380

Met Gly Phe Asp Glu Asp Asn Asp Pro Tyr Ala Ile Ala Asp Val Asn  
 385 390 395 400

Ile Ile Asp Val Asp Phe Glu Lys Gly Gln Asp Phe Ser Leu Asp Arg  
 405 410 415

Ile Ser Asp Tyr Gly Lys Gly Asp Leu Asn Lys Lys Ile Val Val Asp  
 420 425 430

Phe Lys Gly Ile Ala Leu Lys Met Gln Lys Arg Ser Thr Asn Lys Asn  
 435 440 445

Pro Ser Lys Val Gln Pro Val Phe Ala Asn Gly Ala Ala Thr Val Gly  
 450 455 460

Pro Glu Ala Ser Lys Ala Ser Ser Gly Ala Ser Ala Ser Ala Ser Ala  
 465 470 475 480

Ala Pro Ala Lys Pro Ala Phe Ser Ala Asp Val Leu Ala Pro Lys Pro  
 485 490 495

Val Ala Leu Pro Glu His Ile Leu Lys Gly Asp Ala Leu Ala Pro Lys  
 500 505 510

Glu Met Ser Trp His Pro Met Ala Arg Ile Pro Gly Asn Pro Thr Pro  
 515 520 525

Ser Phe Ala Pro Ser Ala Tyr Lys Pro Arg Asn Ile Ala Phe Thr Pro  
 530 535 540

Phe Pro Gly Asn Pro Asn Asp Asn Asp His Thr Pro Gly Lys Met Pro  
 545 550 555 560

Leu Thr Trp Phe Asn Met Ala Glu Phe Met Ala Gly Lys Val Ser Met  
 565 570 575

Cys Leu Gly Pro Glu Phe Ala Lys Phe Asp Asp Ser Asn Thr Ser Arg  
 580 585 590

Ser Pro Ala Trp Asp Leu Ala Leu Val Thr Arg Ala Val Ser Val Ser  
 595 600 605

Asp Leu Lys His Val Asn Tyr Arg Asn Ile Asp Leu Asp Pro Ser Lys  
 610 615 620

Gly Thr Met Val Gly Glu Phe Asp Cys Pro Ala Asp Ala Trp Phe Tyr  
 625 630 635 640

Lys Gly Ala Cys Asn Asp Ala His Met Pro Tyr Ser Ile Leu Met Glu  
 645 650 655

Ile Ala Leu Gln Thr Ser Gly Val Leu Thr Ser Val Leu Lys Ala Pro  
 660 665 670

Leu Thr Met Glu Lys Asp Asp Ile Leu Phe Arg Asn Leu Asp Ala Asn  
 675 680 685

Ala Glu Phe Val Arg Ala Asp Leu Asp Tyr Arg Gly Lys Thr Ile Arg  
 690 695 700

Asn Val Thr Lys Cys Thr Gly Tyr Ser Met Leu Gly Glu Met Gly Val  
 705 710 715 720

His Arg Phe Thr Phe Glu Leu Tyr Val Asp Asp Val Leu Phe Tyr Lys  
 725 730 735

Gly Ser Thr Ser Phe Gly Trp Phe Val Pro Glu Val Phe Ala Ala Gln  
 740 745 750

Ala Gly Leu Asp Asn Gly Arg Lys Ser Glu Pro Trp Phe Ile Glu Asn  
 755 760 765

Lys Val Pro Ala Ser Gln Val Ser Ser Phe Asp Val Arg Pro Asn Gly  
 770 775 780

Ser Gly Arg Thr Ala Ile Phe Ala Asn Ala Pro Ser Gly Ala Gln Leu  
 785 790 795 800

Asn Arg Arg Thr Asp Gln Gly Gln Tyr Leu Asp Ala Val Asp Ile Val  
 805 810 815

Ser Gly Ser Gly Lys Lys Ser Leu Gly Tyr Ala His Gly Ser Lys Thr  
820 825 830

Val Asn Pro Asn Asp Trp Phe Phe Ser Cys His Phe Trp Phe Asp Ser  
835 840 845

Val Met Pro Gly Ser Leu Gly Val Glu Ser Met Phe Gln Leu Val Glu  
850 855 860

Ala Ile Ala Ala His Glu Asp Leu Ala Gly Lys Ala Arg His Cys Gln  
865 870 875 880

Pro His Leu Cys Ala Arg Pro Arg Ala Arg Ser Ser Trp Lys Tyr Arg  
885 890 895

Gly Gln Leu Thr Pro Lys Ser Lys Lys Met Asp Ser Glu Val His Ile  
900 905 910

Val Ser Val Asp Ala His Asp Gly Val Val Asp Leu Val Ala Asp Gly  
915 920 925

Phe Leu Trp Ala Asp Ser Leu Arg Val Tyr Ser Val Ser Asn Ile Arg  
930 935 940

Val Arg Ile Ala Ser Gly Glu Ala Pro Ala Ala Ser Ser Ala Ala  
945 950 955 960

Ser Val Gly Ser Ser Ala Ser Ser Val Glu Arg Thr Arg Ser Ser Pro  
965 970 975

Ala Val Ala Ser Gly Pro Ala Gln Thr Ile Asp Leu Lys Gln Leu Lys  
980 985 990

Thr Glu Leu Leu Glu Leu Asp Ala Pro Leu Tyr Leu Ser Gln Asp Pro  
995 1000 1005

Thr Ser Gly Gln Leu Lys Lys His Thr Asp Val Ala Ser Gly Gln  
1010 1015 1020

Ala Thr Ile Val Gln Pro Cys Thr Leu Gly Asp Leu Gly Asp Arg  
1025 1030 1035

Ser Phe Met Glu Thr Tyr Gly Val Val Ala Pro Leu Tyr Thr Gly  
1040 1045 1050

Ala Met Ala Lys Gly Ile Ala Ser Ala Asp Leu Val Ile Ala Ala  
1055 1060 1065

Gly Lys Arg Lys Ile Leu Gly Ser Phe Gly Ala Gly Gly Leu Pro  
1070 1075 1080

Met	His	His	Val	Arg	Ala	Ala	Leu	Glu	Lys	Ile	Gln	Ala	Ala	Leu
1085						1090					1095			
Pro	Gln	Gly	Pro	Tyr	Ala	Val	Asn	Leu	Ile	His	Ser	Pro	Phe	Asp
1100						1105					1110			
Ser	Asn	Leu	Glu	Lys	Gly	Asn	Val	Asp	Leu	Phe	Leu	Glu	Lys	Gly
1115						1120					1125			
Val	Thr	Val	Val	Glu	Ala	Ser	Ala	Phe	Met	Thr	Leu	Thr	Pro	Gln
1130						1135					1140			
Val	Val	Arg	Tyr	Arg	Ala	Ala	Gly	Leu	Ser	Arg	Asn	Ala	Asp	Gly
1145						1150					1155			
Ser	Val	Asn	Ile	Arg	Asn	Arg	Ile	Ile	Gly	Lys	Val	Ser	Arg	Thr
1160						1165					1170			
Glu	Leu	Ala	Glu	Met	Phe	Ile	Arg	Pro	Ala	Pro	Glu	His	Leu	Leu
1175						1180					1185			
Glu	Lys	Leu	Ile	Ala	Ser	Gly	Glu	Ile	Thr	Gln	Glu	Gln	Ala	Glu
1190						1195					1200			
Leu	Ala	Arg	Arg	Val	Pro	Val	Ala	Asp	Asp	Ile	Ala	Val	Glu	Ala
1205						1210					1215			
Asp	Ser	Gly	Gly	His	Thr	Asp	Asn	Arg	Pro	Ile	His	Val	Ile	Leu
1220						1225					1230			
Pro	Leu	Ile	Ile	Asn	Leu	Arg	Asn	Arg	Leu	His	Arg	Glu	Cys	Gly
1235						1240					1245			
Tyr	Pro	Ala	His	Leu	Arg	Val	Arg	Val	Gly	Ala	Gly	Gly	Gly	Val
1250						1255					1260			
Gly	Cys	Pro	Gln	Ala	Ala	Ala	Ala	Ala	Leu	Thr	Met	Gly	Ala	Ala
1265						1270					1275			
Phe	Ile	Val	Thr	Gly	Thr	Val	Asn	Gln	Val	Ala	Lys	Gln	Ser	Gly
1280						1285					1290			
Thr	Cys	Asp	Asn	Val	Arg	Lys	Gln	Leu	Ser	Gln	Ala	Thr	Tyr	Ser
1295						1300					1305			
Asp	Ile	Cys	Met	Ala	Pro	Ala	Ala	Asp	Met	Phe	Glu	Glu	Gly	Val
1310						1315					1320			
Lys	Leu	Gln	Val	Leu	Lys	Lys	Gly	Thr	Met	Phe	Pro	Ser	Arg	Ala
1325						1330					1335			

Asn Lys Leu Tyr Glu Leu Phe Cys Lys Tyr Asp Ser Phe Asp Ser  
1340 1345 1350

Met Pro Pro Ala Glu Leu Glu Arg Ile Glu Lys Arg Ile Phe Lys  
1355 1360 1365

Arg Ala Leu Gln Glu Val Trp Glu Glu Thr Lys Asp Phe Tyr Ile  
1370 1375 1380

Asn Gly Leu Lys Asn Pro Glu Lys Ile Gln Arg Ala Glu His Asp  
1385 1390 1395

Pro Lys Leu Lys Met Ser Leu Cys Phe Arg Trp Tyr Leu Gly Leu  
1400 1405 1410

Ala Ser Arg Trp Ala Asn Met Gly Ala Pro Asp Arg Val Met Asp  
1415 1420 1425

Tyr Gln Val Trp Cys Gly Pro Ala Ile Gly Ala Phe Asn Asp Phe  
1430 1435 1440

Ile Lys Gly Thr Tyr Leu Asp Pro Ala Val Ser Asn Glu Tyr Pro  
1445 1450 1455

Cys Val Val Gln Ile Asn Leu Gln Ile Leu Arg Gly Ala Cys Tyr  
1460 1465 1470

Leu Arg Arg Leu Asn Ala Leu Arg Asn Asp Pro Arg Ile Asp Leu  
1475 1480 1485

Glu Thr Glu Asp Ala Ala Phe Val Tyr Glu Pro Thr Asn Ala Leu  
1490 1495 1500

<210> 7  
<211> 600  
<212> DNA  
<213> Schizochytrium sp.

<220>  
<221> CDS  
<222> (1)..(600)

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Met Ala Ala Arg Leu Gln Glu Gln Lys Gly Gly Glu Met Asp Thr Arg  
1 5 10 15  
att gcc atc atc ggc atg tcg gcc atc ctc ccc tgc ggc acg acc gtg 96  
Ile Ala Ile Ile Gly Met Ser Ala Ile Leu Pro Cys Gly Thr Thr Val  
20 25 30  
cgc gag tcg tgg gag acc atc cgc gcc ggc atc gac tgc ctg tcg gat 144  
Arg Glu Ser Trp Glu Thr Ile Arg Ala Gly Ile Asp Cys Leu Ser Asp  
35 40 45  
ctc ccc gag gac cgc gtc gac gtg acg gcg tac ttt gac ccc gtc aag 192

Leu Pro Glu Asp Arg Val Asp Val Thr Ala Tyr Phe Asp Pro Val Lys  
 50 55 60  
 acc acc aag gac aag atc tac tgc aag cgc ggt ggc ttc att ccc gag 240  
 Thr Thr Lys Asp Lys Ile Tyr Cys Lys Arg Gly Gly Phe Ile Pro Glu  
 65 70 75 80  
 tac gac ttt gac gcc cgc gag ttc gga ctc aac atg ttc cag atg gag 288  
 Tyr Asp Phe Asp Ala Arg Glu Phe Gly Leu Asn Met Phe Gln Met Glu  
 85 90 95  
 gac tcg gac gca aac cag acc atc tcg ctt ctc aag gtc aag gag gcc 336  
 Asp Ser Asp Ala Asn Gln Thr Ile Ser Leu Leu Lys Val Lys Glu Ala  
 100 105 110  
 ctc cag gac gcc ggc atc gac gcc ctc ggc aag gaa aag aag aac atc 384  
 Leu Gln Asp Ala Gly Ile Asp Ala Leu Gly Lys Glu Lys Lys Asn Ile  
 115 120 125  
 ggc tgc gtg ctc ggc att ggc ggc ggc caa aag tcc agc cac gag ttc 432  
 Gly Cys Val Leu Gly Ile Gly Gly Gly Gln Lys Ser Ser His Glu Phe  
 130 135 140  
 tac tcg cgc ctt aat tat gtt gtc gtg gag aag gtc ctc cgc aag atg 480  
 Tyr Ser Arg Leu Asn Tyr Val Val Val Glu Lys Val Leu Arg Lys Met  
 145 150 155 160  
 ggc atg ccc gag gag gac gtc aag gtc gcc gtc gaa aag tac aag gcc 528  
 Gly Met Pro Glu Glu Asp Val Lys Val Ala Val Glu Lys Tyr Lys Ala  
 165 170 175  
 aac ttc ccc gag tgg cgc ctc gac tcc ttc cct ggc ttc ctc ggc aac 576  
 Asn Phe Pro Glu Trp Arg Leu Asp Ser Phe Pro Gly Phe Leu Gly Asn  
 180 185 190  
 gtc acc gcc ggt cgc tgc acc aac 600  
 Val Thr Ala Gly Arg Cys Thr Asn  
 195 200

<210> 8  
 <211> 200  
 <212> PRT  
 <213> Schizochytrium sp.

<400> 8

Met Ala Ala Arg Leu Gln Glu Gln Lys Gly Gly Glu Met Asp Thr Arg  
 1 5 10 15

Ile Ala Ile Ile Gly Met Ser Ala Ile Leu Pro Cys Gly Thr Thr Val  
 20 25 30

Arg Glu Ser Trp Glu Thr Ile Arg Ala Gly Ile Asp Cys Leu Ser Asp  
 35 40 45

Leu Pro Glu Asp Arg Val Asp Val Thr Ala Tyr Phe Asp Pro Val Lys  
 50 55 60

Thr Thr Lys Asp Lys Ile Tyr Cys Lys Arg Gly Gly Phe Ile Pro Glu  
 65 70 75 80

Tyr Asp Phe Asp Ala Arg Glu Phe Gly Leu Asn Met Phe Gln Met Glu



85	90	95
Asp Ser Asp Ala Asn Gln Thr Ile Ser Leu Leu Lys Val Lys Glu Ala		
100	105	110
Leu Gln Asp Ala Gly Ile Asp Ala Leu Gly Lys Glu Lys Lys Asn Ile		
115	120	125
Gly Cys Val Leu Gly Ile Gly Gly Gly Gln Lys Ser Ser His Glu Phe		
130	135	140
Tyr Ser Arg Leu Asn Tyr Val Val Val Glu Lys Val Leu Arg Lys Met		
145	150	155
Gly Met Pro Glu Glu Asp Val Lys Val Ala Val Glu Lys Tyr Lys Ala		
165	170	175
Asn Phe Pro Glu Trp Arg Leu Asp Ser Phe Pro Gly Phe Leu Gly Asn		
180	185	190
Val Thr Ala Gly Arg Cys Thr Asn		
195	200	

<210> 9  
 <211> 1278  
 <212> DNA  
 <213> Schizochytrium sp.

<220>  
 <221> CDS  
 <222> (1)..(1278)

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Asp Val Thr Lys Glu Ala Trp Arg Leu Pro Arg Glu Gly Val Ser Phe	
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cgc gcc aag ggc atc gcc acc aac ggc gct gtc gcc gcg ctc ttc tcc	96
Arg Ala Lys Gly Ile Ala Thr Asn Gly Ala Val Ala Ala Leu Phe Ser	
20 25 30	
ggc cag ggc gcg cag tac acg cac atg ttt agc gag gtg gcc atg aac	144
Gly Gln Gly Ala Gln Tyr Thr His Met Phe Ser Glu Val Ala Met Asn	
35 40 45	
tgg ccc cag ttc cgc cag agc att gcc gcc atg gac gcc gcc cag tcc	192
Trp Pro Gln Phe Arg Gln Ser Ile Ala Ala Met Asp Ala Ala Gln Ser	
50 55 60	
aag gtc gct gga agc gac aag gac ttt gag cgc gtc tcc cag gtc ctc	240
Lys Val Ala Gly Ser Asp Lys Asp Phe Glu Arg Val Ser Gln Val Leu	
65 70 75 80	
tac ccg cgc aag ccg tac gag cgt gag ccc gag cag aac ccc aag aag	288
Tyr Pro Arg Lys Pro Tyr Glu Arg Glu Pro Glu Gln Asn Pro Lys Lys	
85 90 95	
atc tcc ctc acc gcc tac tcg cag ccc tcg acc ctg gcc tgc gct ctc	336
Ile Ser Leu Thr Ala Tyr Ser Gln Pro Ser Thr Leu Ala Cys Ala Leu	

100										105										110										
ggt	gcc	ttt	gag	atc	ttc	aag	gag	gcc	ggc	ttc	acc	ccg	gac	ttt	gcc	384														
Gly	Ala	Phe	Glu	Ile	Phe	Lys	Glu	Ala	Gly	Phe	Thr	Pro	Asp	Phe	Ala															
		115						120					125																	
gcc	ggc	cat	tcg	ctc	ggt	gag	ttc	gcc	ggc	ctc	tac	gcc	gcg	ggc	tgc	432														
Ala	Gly	His	Ser	Leu	Gly	Glu	Phe	Ala	Ala	Leu	Tyr	Ala	Ala	Gly	Cys															
	130					135					140																			
gtc	gac	cgc	gac	gag	ctc	ttt	gag	ctt	gtc	tgc	cgc	cgc	gcc	cgc	atc	480														
Val	Asp	Arg	Asp	Glu	Leu	Phe	Glu	Leu	Val	Cys	Arg	Arg	Ala	Arg	Ile															
	145				150					155					160															
atg	ggc	ggc	aag	gac	gca	ccg	gcc	acc	ccc	aag	gga	tgc	atg	gcc	gcc	528														
Met	Gly	Gly	Lys	Asp	Ala	Pro	Ala	Thr	Pro	Lys	Gly	Cys	Met	Ala	Ala															
			165						170					175																
gtc	att	ggc	ccc	aac	gcc	gag	aac	atc	aag	gtc	cag	gcc	gcc	aac	gtc	576														
Val	Ile	Gly	Pro	Asn	Ala	Glu	Asn	Ile	Lys	Val	Gln	Ala	Ala	Asn	Val															
			180					185					190																	
tgg	ctc	ggc	aac	tcc	aac	tcg	cct	tcg	cag	acc	gtc	atc	acc	ggc	tcc	624														
Trp	Leu	Gly	Asn	Ser	Asn	Ser	Pro	Ser	Gln	Thr	Val	Ile	Thr	Gly	Ser															
		195					200					205																		
gtc	gaa	ggt	atc	cag	gcc	gag	agc	gcc	cgc	ctc	cag	aag	gag	ggc	ttc	672														
Val	Glu	Gly	Ile	Gln	Ala	Glu	Ser	Ala	Arg	Leu	Gln	Lys	Glu	Gly	Phe															
	210					215					220																			
cgc	gtc	gtg	cct	ctt	gcc	tgc	gag	agc	gcc	ttc	cac	tcg	ccc	cag	atg	720														
Arg	Val	Val	Pro	Leu	Ala	Cys	Glu	Ser	Ala	Phe	His	Ser	Pro	Gln	Met															
	225				230					235					240															
gag	aac	gcc	tcg	tcg	gcc	ttc	aag	gac	gtc	atc	tcc	aag	gtc	tcc	ttc	768														
Glu	Asn	Ala	Ser	Ser	Ala	Phe	Lys	Asp	Val	Ile	Ser	Lys	Val	Ser	Phe															
			245						250					255																
cgc	acc	ccc	aag	gcc	gag	acc	aag	ctc	ttc	agc	aac	gtc	tct	ggc	gag	816														
Arg	Thr	Pro	Lys	Ala	Glu	Thr	Lys	Leu	Phe	Ser	Asn	Val	Ser	Gly	Glu															
			260					265					270																	
acc	tac	ccc	acg	gac	gcc	cgc	gag	atg	ctt	acg	cag	cac	atg	acc	agc	864														
Thr	Tyr	Pro	Thr	Asp	Ala	Arg	Glu	Met	Leu	Thr	Gln	His	Met	Thr	Ser															
		275					280					285																		
agc	gtc	aag	ttc	ctc	acc	cag	gtc	cgc	aac	atg	cac	cag	gcc	ggt	gcg	912														
Ser	Val	Lys	Phe	Leu	Thr	Gln	Val	Arg	Asn	Met	His	Gln	Ala	Gly	Ala															
	290					295					300																			
cgc	atc	ttt	gtc	gag	ttc	gga	ccc	aag	cag	gtg	ctc	tcc	aag	ctt	gtc	960														
Arg	Ile	Phe	Val	Glu	Phe	Gly	Pro	Lys	Gln	Val	Leu	Ser	Lys	Leu	Val															
	305				310					315					320															
tcc	gag	acc	ctc	aag	gat	gac	ccc	tcg	gtt	gtc	acc	gtc	tct	gtc	aac	1008														
Ser	Glu	Thr	Leu	Lys	Asp	Asp	Pro	Ser	Val	Val	Thr	Val	Ser	Val	Asn															
			325						330					335																
ccg	gcc	tcg	ggc	acg	gat	tcg	gac	atc	cag	ctc	cgc	gac	gcg	gcc	gtc	1056														
Pro	Ala	Ser	Gly	Thr	Asp	Ser	Asp	Ile	Gln	Leu	Arg	Asp	Ala	Ala	Val															
			340					345					350																	
cag	ctc	gtt	gtc	gct	ggc	gtc	aac	ctt	cag	ggc	ttt	gac	aag	tgg	gac	1104														
Gln	Leu	Val	Val	Ala	Gly	Val	Asn	Leu	Gln	Gly	Phe	Asp	Lys	Trp	Asp															
		355					360					365																		
gcc	ccc	gat	gcc	acc	cgc	atg	cag	gcc	atc	aag	aag	aag	cgc	act	acc	1152														
Ala	Pro	Asp	Ala	Thr	Arg	Met	Gln	Ala	Ile	Lys	Lys	Lys	Arg	Thr	Thr															

370                      375                      380  
 ctc cgc ctt tcg gcc gcc acc tac gtc tcg gac aag acc aag aag gtc 1200  
 Leu Arg Leu Ser Ala Ala Thr Tyr Val Ser Asp Lys Thr Lys Lys Val  
 385                      390                      395                      400  
 cgc gac gcc gcc atg aac gat ggc cgc tgc gtc acc tac ctc aag ggc 1248  
 Arg Asp Ala Ala Met Asn Asp Gly Arg Cys Val Thr Tyr Leu Lys Gly  
 405                      410                      415  
 gcc gca ccg ctc atc aag gcc ccg gag ccc 1278  
 Ala Ala Pro Leu Ile Lys Ala Pro Glu Pro  
 420                      425

<210> 10  
 <211> 426  
 <212> PRT  
 <213> Schizochytrium sp.

<400> 10

Asp Val Thr Lys Glu Ala Trp Arg Leu Pro Arg Glu Gly Val Ser Phe  
 1                      5                      10                      15

Arg Ala Lys Gly Ile Ala Thr Asn Gly Ala Val Ala Ala Leu Phe Ser  
 20                      25                      30

Gly Gln Gly Ala Gln Tyr Thr His Met Phe Ser Glu Val Ala Met Asn  
 35                      40                      45

Trp Pro Gln Phe Arg Gln Ser Ile Ala Ala Met Asp Ala Ala Gln Ser  
 50                      55                      60

Lys Val Ala Gly Ser Asp Lys Asp Phe Glu Arg Val Ser Gln Val Leu  
 65                      70                      75                      80

Tyr Pro Arg Lys Pro Tyr Glu Arg Glu Pro Glu Gln Asn Pro Lys Lys  
 85                      90                      95

Ile Ser Leu Thr Ala Tyr Ser Gln Pro Ser Thr Leu Ala Cys Ala Leu  
 100                      105                      110

Gly Ala Phe Glu Ile Phe Lys Glu Ala Gly Phe Thr Pro Asp Phe Ala  
 115                      120                      125

Ala Gly His Ser Leu Gly Glu Phe Ala Ala Leu Tyr Ala Ala Gly Cys  
 130                      135                      140

Val Asp Arg Asp Glu Leu Phe Glu Leu Val Cys Arg Arg Ala Arg Ile  
 145                      150                      155                      160

Met Gly Gly Lys Asp Ala Pro Ala Thr Pro Lys Gly Cys Met Ala Ala  
 165                      170                      175

Val Ile Gly Pro Asn Ala Glu Asn Ile Lys Val Gln Ala Ala Asn Val  
 180                      185                      190

Trp Leu Gly Asn Ser Asn Ser Pro Ser Gln Thr Val Ile Thr Gly Ser  
 195 200 205

Val Glu Gly Ile Gln Ala Glu Ser Ala Arg Leu Gln Lys Glu Gly Phe  
 210 215 220

Arg Val Val Pro Leu Ala Cys Glu Ser Ala Phe His Ser Pro Gln Met  
 225 230 235 240

Glu Asn Ala Ser Ser Ala Phe Lys Asp Val Ile Ser Lys Val Ser Phe  
 245 250 255

Arg Thr Pro Lys Ala Glu Thr Lys Leu Phe Ser Asn Val Ser Gly Glu  
 260 265 270

Thr Tyr Pro Thr Asp Ala Arg Glu Met Leu Thr Gln His Met Thr Ser  
 275 280 285

Ser Val Lys Phe Leu Thr Gln Val Arg Asn Met His Gln Ala Gly Ala  
 290 295 300

Arg Ile Phe Val Glu Phe Gly Pro Lys Gln Val Leu Ser Lys Leu Val  
 305 310 315 320

Ser Glu Thr Leu Lys Asp Asp Pro Ser Val Val Thr Val Ser Val Asn  
 325 330 335

Pro Ala Ser Gly Thr Asp Ser Asp Ile Gln Leu Arg Asp Ala Ala Val  
 340 345 350

Gln Leu Val Val Ala Gly Val Asn Leu Gln Gly Phe Asp Lys Trp Asp  
 355 360 365

Ala Pro Asp Ala Thr Arg Met Gln Ala Ile Lys Lys Lys Arg Thr Thr  
 370 375 380

Leu Arg Leu Ser Ala Ala Thr Tyr Val Ser Asp Lys Thr Lys Lys Val  
 385 390 395 400

Arg Asp Ala Ala Met Asn Asp Gly Arg Cys Val Thr Tyr Leu Lys Gly  
 405 410 415

Ala Ala Pro Leu Ile Lys Ala Pro Glu Pro  
 420 425

<210> 11  
 <211> 5  
 <212> PRT  
 <213> Schizochytrium sp.

<220>

<221> MISC\_FEATURE  
 <222> (1)..(5)  
 <223> Xaa = any amino acid

<400> 11

Gly His Ser Xaa Gly  
 1 5

<210> 12  
 <211> 258  
 <212> DNA  
 <213> Schizochytrium sp.

<220>  
 <221> CDS  
 <222> (1)..(258)

<400> 12  
 gct gtc tcg aac gag ctt ctt gag aag gcc gag act gtc gtc atg gag 48  
 Ala Val Ser Asn Glu Leu Leu Glu Lys Ala Glu Thr Val Val Met Glu  
 1 5 10 15  
 gtc ctc gcc gcc aag acc ggc tac gag acc gac atg atc gag gct gac 96  
 Val Leu Ala Ala Lys Thr Gly Tyr Glu Thr Asp Met Ile Glu Ala Asp  
 20 25 30  
 atg gag ctc gag acc gag ctc ggc att gac tcc atc aag cgt gtc gag 144  
 Met Glu Leu Glu Thr Glu Leu Gly Ile Asp Ser Ile Lys Arg Val Glu  
 35 40 45  
 atc ctc tcc gag gtc cag gcc atg ctc aat gtc gag gcc aag gat gtc 192  
 Ile Leu Ser Glu Val Gln Ala Met Leu Asn Val Glu Ala Lys Asp Val  
 50 55 60  
 gat gcc ctc agc cgc act cgc act gtt ggt gag gtt gtc aac gcc atg 240  
 Asp Ala Leu Ser Arg Thr Arg Thr Val Gly Glu Val Val Asn Ala Met  
 65 70 75 80  
 aag gcc gag atc gct ggc 258  
 Lys Ala Glu Ile Ala Gly  
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<210> 13  
 <211> 86  
 <212> PRT  
 <213> Schizochytrium sp.

<400> 13

Ala Val Ser Asn Glu Leu Leu Glu Lys Ala Glu Thr Val Val Met Glu  
 1 5 10 15  
 Val Leu Ala Ala Lys Thr Gly Tyr Glu Thr Asp Met Ile Glu Ala Asp  
 20 25 30  
 Met Glu Leu Glu Thr Glu Leu Gly Ile Asp Ser Ile Lys Arg Val Glu  
 35 40 45  
 Ile Leu Ser Glu Val Gln Ala Met Leu Asn Val Glu Ala Lys Asp Val  
 50 55 60

Asp Ala Leu Ser Arg Thr Arg Thr Val Gly Glu Val Val Asn Ala Met  
 65 70 75 80

Lys Ala Glu Ile Ala Gly  
 85

<210> 14  
 <211> 5  
 <212> PRT  
 <213> Schizochytrium sp.

<400> 14

Leu Gly Ile Asp Ser  
 1 5

<210> 15  
 <211> 21  
 <212> PRT  
 <213> Schizochytrium sp.

<400> 15

Ala Pro Ala Pro Val Lys Ala Ala Ala Pro Ala Ala Pro Val Ala Ser  
 1 5 10 15

Ala Pro Ala Pro Ala  
 20

<210> 16  
 <211> 3006  
 <212> DNA  
 <213> Schizochytrium sp.

<400> 16  
 gcccccgccc cgggtcaaggc tgctgcgccct gccgcccccg ttgcctcggc ccctgccccg 60  
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 aagaccggct acgagaccga catgatcgag gctgacatgg agctcgagac cgagctcggc 180  
 attgactcca tcaagcgtgt cgagatcctc tccgaggtcc aggccatgct caatgtcgag 240  
 gccaaaggatg tcgatgccct cagccgcact cgcactgttg gtgaggttgt caacgccatg 300  
 aaggccgaga tcgctggcag ctctgccccg gcgcctgctg ccgctgctcc ggctccggcc 360  
 aaggctgccc ctgccgccgc tgcgcctgct gtctcgaacg agcttctcga gaaggccgag 420  
 accgtcgtca tggagggtcct cgccgcccaag actggctacg agactgacat gatcgagtcc 480  
 gacatggagc tcgagactga gctcggcatt gactccatca agcgtgtcga gatcctctcc 540  
 gaggttcagg ccatgctcaa cgtcgaggcc aaggacgtcg acgctctcag ccgcactcgc 600  
 actgtgggtg aggtcgtcaa cgccatgaag gctgagatcg ctggtggctc tgccccggcg 660  
 cctgccgccg ctgccccagg tccggctgct gccgccctg cgctcgccgc cgccgccct 720  
 gctgtctcga acgagcttct tgagaaggcc gagaccgtcg tcatggaggt cctcgccgcc 780  
 aagactggct acgagactga catgatcgag tccgacatgg agctcgagac cgagctcggc 840

attgactcca	tcaagcgtgt	cgagattctc	tccgaggtcc	aggccatgct	caacgtcgag	900
gccaaaggacg	tcgacgctct	cagccgcacc	cgcaactgttg	gcgaggtcgt	cgatgccatg	960
aaggccgaga	tcgctggtgg	ctctgccccg	gcgcctgccg	ccgctgctcc	tgtccggct	1020
gctgccgccc	ctgcgcctgc	cgcccctgcg	cctgctgtct	cgagcgagct	tctcgagaag	1080
gccgagactg	tcgtcatgga	ggctctcgcc	gccaaagactg	gctacgagac	tgacatgac	1140
gagtccgaca	tggagctcga	gaccgagctc	ggcattgact	ccatcaagcg	tgtcgagatt	1200
ctctccgagg	tccaggccat	gctcaacgtc	gaggccaagg	acgtcgacgc	tctcagccgc	1260
accgcactg	ttggcgaggt	cgctgatgcc	atgaaggccg	agatcgctgg	tggctctgcc	1320
ccggcgcttg	ccgccgctgc	tcttgctccg	gctgctgccg	cccctgcgcc	tgccgcccct	1380
gcgcctgccg	cccctgcgcc	tgtgtctcgc	agcgagcttc	tcgagaaggc	cgagactgtc	1440
gtcatggagg	tcttcgcccc	caagactggc	tacgagactg	acatgattga	gtccgacatg	1500
gagctcgaga	ccgagctcgg	cattgactcc	atcaagcgtg	tcgagattct	ctccgaggtt	1560
caggccatgc	tcaacgtcga	ggccaaggac	gtcgacgctc	tcagccgcac	tcgcaactgtt	1620
ggtgaggtcg	tcgatgccat	gaaggctgag	atcgctggca	gtccgcctc	ggcgctgcc	1680
gccgctgctc	ctgtccggc	tgtgcccgt	cctgcgcccg	ctgccgcgc	ccctgctgtc	1740
tcgaacgagc	ttctcgagaa	agccgagact	gtcgtcatgg	aggtcctcgc	cgccaagact	1800
ggctacgaga	ctgacatgat	cgagtccgac	atggagctcg	agactgagct	cggcattgac	1860
tccatcaagc	gtgtcgagat	cctctccgag	gttcaggcca	tgtcaacgt	cgaggccaag	1920
gacgtcgatg	ccctcagccg	caccgcact	gttggcgagg	ttgtcgatgc	catgaaggcc	1980
gagatcgctg	gtggctctgc	ccggcgccct	gccgcgctg	cccctgctcc	ggctgccgcc	2040
gcccctgctg	tctcgaacga	gcttctcgag	aaggccgaga	ctgtcgtcat	ggaggtcctc	2100
gccgccaaaga	ctggctacga	gaccgacatg	atcgagtccg	acatggagct	cgagaccgag	2160
ctcggcattg	actccatcaa	gcgtgtcgag	attctctccg	aggttcaggc	catgctcaac	2220
gtcgaggcca	aggacgtcga	tgtctcagc	cgcaactcgca	ctgttggcga	ggctcgtgat	2280
gccatgaagg	ctgagatcgc	cggcagctcc	gccccggcgc	ctgccgcgc	tgtcctgct	2340
ccggctgctg	ccgtcctgc	gcccgtgcc	gctgcccctg	ctgtctcgag	cgagcttctc	2400
gagaaggccg	agaccgtcgt	catggaggtc	ctcgccgcca	agactggcta	cgagactgac	2460
atgattgagt	ccgacatgga	gctcgagact	gagctcggca	ttgactccat	caagcgtgtc	2520
gagatecctct	ccgaggttca	ggccatgctc	aacgtcgagg	ccaaggacgt	cgatgccctc	2580
agccgcaccc	gcaactgttg	cgaggttgtc	gatgccatga	aggccgagat	cgctggtggc	2640
tctgcccccg	cgctgcgc	cgctgcccct	gtccggctg	ccgccgccc	tgtgtctcg	2700
aacgagcttc	ttgagaaggc	cgagaccgtc	gtcatggagg	tcctcgccgc	caagactggc	2760
tacgagaccg	acatgatcga	gtccgacatg	gagctcgaga	ccgagctcgg	cattgactcc	2820
atcaagcgtg	tcgagattct	ctccgaggtt	caggccatgc	tcaacgtcga	ggccaaggac	2880

gtcgacgctc tcagccgcac tcgcactgtt ggcgaggtcg tcgatgccat gaaggctgag 2940  
 atcgctggtg gctctgcccc ggcgcctgcc gccgctgctc ctgcctcggc tggcgccgcg 3000  
 cctgcg 3006

<210> 17  
 <211> 2133  
 <212> DNA  
 <213> Schizochytrium sp.

<220>  
 <221> CDS  
 <222> (1)..(2133)

<400> 17  
 ttt ggc gct ctc ggc ggc ttc atc tcg cag cag gcg gag cgc ttc gag 48  
 Phe Gly Ala Leu Gly Gly Phe Ile Ser Gln Gln Ala Glu Arg Phe Glu  
 1 5 10 15  
 ccc gcc gaa atc ctc ggc ttc acg ctc atg tgc gcc aag ttc gcc aag 96  
 Pro Ala Glu Ile Leu Gly Phe Thr Leu Met Cys Ala Lys Phe Ala Lys  
 20 25 30  
 gct tcc ctc tgc acg gct gtg gct ggc ggc cgc ccg gcc ttt atc ggt 144  
 Ala Ser Leu Cys Thr Ala Val Ala Gly Gly Arg Pro Ala Phe Ile Gly  
 35 40 45  
 gtg gcg cgc ctt gac ggc cgc ctc gga ttc act tcg cag ggc act tct 192  
 Val Ala Arg Leu Asp Gly Arg Leu Gly Phe Thr Ser Gln Gly Thr Ser  
 50 55 60  
 gac gcg ctc aag cgt gcc cag cgt ggt gcc atc ttt ggc ctc tgc aag 240  
 Asp Ala Leu Lys Arg Ala Gln Arg Gly Ala Ile Phe Gly Leu Cys Lys  
 65 70 75 80  
 acc atc ggc ctc gag tgg tcc gag tct gac gtc ttt tcc cgc ggc gtg 288  
 Thr Ile Gly Leu Glu Trp Ser Glu Ser Asp Val Phe Ser Arg Gly Val  
 85 90 95  
 gac att gct cag ggc atg cac ccc gag gat gcc gcc gtg gcg att gtg 336  
 Asp Ile Ala Gln Gly Met His Pro Glu Asp Ala Ala Val Ala Ile Val  
 100 105 110  
 cgc gag atg gcg tgc gct gac att cgc att cgc gag gtc ggc att ggc 384  
 Arg Glu Met Ala Cys Ala Asp Ile Arg Ile Arg Glu Val Gly Ile Gly  
 115 120 125  
 gca aac cag cag cgc tgc acg atc cgt gcc gcc aag ctc gag acc ggc 432  
 Ala Asn Gln Gln Arg Cys Thr Ile Arg Ala Ala Lys Leu Glu Thr Gly  
 130 135 140  
 aac ccg cag cgc cag atc gcc aag gac gac gtg ctg ctc gtt tct ggc 480  
 Asn Pro Gln Arg Gln Ile Ala Lys Asp Asp Val Leu Leu Val Ser Gly  
 145 150 155 160  
 ggc gct cgc ggc atc acg cct ctt tgc atc cgg gag atc acg cgc cag 528  
 Gly Ala Arg Gly Ile Thr Pro Leu Cys Ile Arg Glu Ile Thr Arg Gln  
 165 170 175  
 atc gcg ggc ggc aag tac att ctg ctt ggc cgc agc aag gtc tct gcg 576  
 Ile Ala Gly Gly Lys Tyr Ile Leu Leu Gly Arg Ser Lys Val Ser Ala  
 180 185 190  
 agc gaa ccg gca tgg tgc gct ggc atc act gac gag aag gct gtg caa 624  
 Ser Glu Pro Ala Trp Cys Ala Gly Ile Thr Asp Glu Lys Ala Val Gln



195	200	205	
aag gct gct acc cag gag ctc Lys Ala Ala Thr Gln Glu Leu 210	aag cgc gcc ttt agc gct ggc gag ggc Lys Arg Ala Phe Ser Ala Gly Glu Gly 215		672
ccc aag ccc acg ccc cgc gct gtc act aag ctt gtg ggc tct gtt ctt Pro Lys Pro Thr Pro Arg Ala Val Thr Lys Leu Val Gly Ser Val Leu 225		235	720
ggc gct cgc gag gtg cgc agc tct att gct cgc att gaa gcg ctc ggc Gly Ala Arg Glu Val Arg Ser Ser Ile Ala Ala Ile Glu Ala Leu Gly 245		250	768
ggc aag gcc atc tac tcg tcg tgc gac gtg aac tct gcc gcc gac gtg Gly Lys Ala Ile Tyr Ser Ser Cys Asp Val Asn Ser Ala Ala Asp Val 260		265	816
gcc aag gcc gtg cgc gat gcc gag tcc cag ctc ggt gcc cgc gtc tcg Ala Lys Ala Val Arg Asp Ala Glu Ser Gln Leu Gly Ala Arg Val Ser 275		280	864
ggc atc gtt cat gcc tcg ggc gtg ctc cgc gac cgt ctc atc gag aag Gly Ile Val His Ala Ser Gly Val Leu Arg Asp Arg Leu Ile Glu Lys 290		300	912
aag ctc ccc gac gag ttc gac gcc gtc ttt ggc acc aag gtc acc ggt Lys Leu Pro Asp Glu Phe Asp Ala Val Phe Gly Thr Lys Val Thr Gly 305		315	960
ctc gag aac ctc ctc gcc gcc gtc gac cgc gcc aac ctc aag cac atg Leu Glu Asn Leu Leu Ala Ala Val Asp Arg Ala Asn Leu Lys His Met 325		330	1008
gtc ctc ttc agc tcg ctc gcc ggc ttc cac ggc aac gtc ggc cag tct Val Leu Phe Ser Ser Leu Ala Gly Phe His Gly Asn Val Gly Gln Ser 340		345	1056
gac tac gcc atg gcc aac gag gcc ctt aac aag atg ggc ctc gag ctc Asp Tyr Ala Met Ala Asn Glu Ala Leu Asn Lys Met Gly Leu Glu Leu 355		360	1104
gcc aag gac gtc tcg gtc aag tcg atc tgc ttc ggt ccc tgg gac ggt Ala Lys Asp Val Ser Val Lys Ser Ile Cys Phe Gly Pro Trp Asp Gly 370		375	1152
ggc atg gtg acg ccg cag ctc aag aag cag ttc cag gag atg ggc gtg Gly Met Val Thr Pro Gln Leu Lys Lys Gln Phe Gln Glu Met Gly Val 385		390	1200
cag atc atc ccc cgc gag ggc ggc gct gat acc gtg gcg cgc atc gtg Gln Ile Ile Pro Arg Glu Gly Gly Ala Asp Thr Val Ala Arg Ile Val 405		410	1248
ctc ggc tcc tcg ccg gct gag atc ctt gtc ggc aac tgg cgc acc ccg Leu Gly Ser Ser Pro Ala Glu Ile Leu Val Gly Asn Trp Arg Thr Pro 420		425	1296
tcc aag aag gtc ggc tcg gac acc atc acc ctg cac cgc aag att tcc Ser Lys Lys Val Gly Ser Asp Thr Ile Thr Leu His Arg Lys Ile Ser 435		440	1344
gcc aag tcc aac ccc ttc ctc gag gac cac gtc atc cag ggc cgc cgc Ala Lys Ser Asn Pro Phe Leu Glu Asp His Val Ile Gln Gly Arg Arg 450		455	1392
gtg ctg ccc atg acg ctg gcc att ggc tcg ctc gcg gag acc tgc ctc Val Leu Pro Met Thr Leu Ala Ile Gly Ser Leu Ala Glu Thr Cys Leu 460			1440

465	470	475	480	
ggc ctc ttc ccc ggc tac tcg ctc tgg gcc att gac gac gcc cag ctc Gly Leu Phe Pro Gly Tyr Ser Leu Trp Ala Ile Asp Asp Ala Gln Leu 485 490 495				1488
ttc aag ggt gtc act gtc gac ggc gac gtc aac tgc gag gtg acc ctc Phe Lys Gly Val Thr Val Asp Gly Asp Val Asn Cys Glu Val Thr Leu 500 505 510				1536
acc ccg tcg acg gcg ccc tcg ggc cgc gtc aac gtc cag gcc acg ctc Thr Pro Ser Thr Ala Pro Ser Gly Arg Val Asn Val Gln Ala Thr Leu 515 520 525				1584
aag acc ttt tcc agc ggc aag ctg gtc ccg gcc tac cgc gcc gtc atc Lys Thr Phe Ser Ser Gly Lys Leu Val Pro Ala Tyr Arg Ala Val Ile 530 535 540				1632
gtg ctc tcc aac cag ggc gcg ccc ccg gcc aac gcc acc atg cag ccg Val Leu Ser Asn Gln Gly Ala Pro Pro Ala Asn Ala Thr Met Gln Pro 545 550 555 560				1680
ccc tcg ctc gat gcc gat ccg gcg ctc cag ggc tcc gtc tac gac ggc Pro Ser Leu Asp Ala Asp Pro Ala Leu Gln Gly Ser Val Tyr Asp Gly 565 570 575				1728
aag acc ctc ttc cac ggc ccg gcc ttc cgc ggc atc gat gac gtg ctc Lys Thr Leu Phe His Gly Pro Ala Phe Arg Gly Ile Asp Asp Val Leu 580 585 590				1776
tcg tgc acc aag agc cag ctt gtg gcc aag tgc agc gct gtc ccc ggc Ser Cys Thr Lys Ser Gln Leu Val Ala Lys Cys Ser Ala Val Pro Gly 595 600 605				1824
tcc gac gcc gct cgc ggc gag ttt gcc acg gac act gac gcc cat gac Ser Asp Ala Ala Arg Gly Glu Phe Ala Thr Asp Thr Asp Ala His Asp 610 615 620				1872
ccc ttc gtg aac gac ctg gcc ttt cag gcc atg ctc gtc tgg gtg cgc Pro Phe Val Asn Asp Leu Ala Phe Gln Ala Met Leu Val Trp Val Arg 625 630 635 640				1920
cgc acg ctc ggc cag gct gcg ctc ccc aac tcg atc cag cgc atc gtc Arg Thr Leu Gly Gln Ala Leu Pro Asn Ser Ile Gln Arg Ile Val 645 650 655				1968
cag cac cgc ccg gtc ccg cag gac aag ccc ttc tac att acc ctc cgc Gln His Arg Pro Val Pro Gln Asp Lys Pro Phe Tyr Ile Thr Leu Arg 660 665 670				2016
tcc aac cag tcg ggc ggt cac tcc cag cac aag cac gcc ctt cag ttc Ser Asn Gln Ser Gly Gly His Ser Gln His Lys His Ala Leu Gln Phe 675 680 685				2064
cac aac gag cag ggc gat ctc ttc att gat gtc cag gct tcg gtc atc His Asn Glu Gln Gly Asp Leu Phe Ile Asp Val Gln Ala Ser Val Ile 690 695 700				2112
gcc acg gac agc ctt gcc ttc Ala Thr Asp Ser Leu Ala Phe 705 710				2133

<210> 18  
 <211> 711  
 <212> PRT  
 <213> Schizochytrium sp.

<400> 18

Phe Gly Ala Leu Gly Gly Phe Ile Ser Gln Gln Ala Glu Arg Phe Glu  
1 5 10 15

Pro Ala Glu Ile Leu Gly Phe Thr Leu Met Cys Ala Lys Phe Ala Lys  
20 25 30

Ala Ser Leu Cys Thr Ala Val Ala Gly Gly Arg Pro Ala Phe Ile Gly  
35 40 45

Val Ala Arg Leu Asp Gly Arg Leu Gly Phe Thr Ser Gln Gly Thr Ser  
50 55 60

Asp Ala Leu Lys Arg Ala Gln Arg Gly Ala Ile Phe Gly Leu Cys Lys  
65 70 75 80

Thr Ile Gly Leu Glu Trp Ser Glu Ser Asp Val Phe Ser Arg Gly Val  
85 90 95

Asp Ile Ala Gln Gly Met His Pro Glu Asp Ala Ala Val Ala Ile Val  
100 105 110

Arg Glu Met Ala Cys Ala Asp Ile Arg Ile Arg Glu Val Gly Ile Gly  
115 120 125

Ala Asn Gln Gln Arg Cys Thr Ile Arg Ala Ala Lys Leu Glu Thr Gly  
130 135 140

Asn Pro Gln Arg Gln Ile Ala Lys Asp Asp Val Leu Leu Val Ser Gly  
145 150 155 160

Gly Ala Arg Gly Ile Thr Pro Leu Cys Ile Arg Glu Ile Thr Arg Gln  
165 170 175

Ile Ala Gly Gly Lys Tyr Ile Leu Leu Gly Arg Ser Lys Val Ser Ala  
180 185 190

Ser Glu Pro Ala Trp Cys Ala Gly Ile Thr Asp Glu Lys Ala Val Gln  
195 200 205

Lys Ala Ala Thr Gln Glu Leu Lys Arg Ala Phe Ser Ala Gly Glu Gly  
210 215 220

Pro Lys Pro Thr Pro Arg Ala Val Thr Lys Leu Val Gly Ser Val Leu  
225 230 235 240

Gly Ala Arg Glu Val Arg Ser Ser Ile Ala Ala Ile Glu Ala Leu Gly  
245 250 255

Gly Lys Ala Ile Tyr Ser Ser Cys Asp Val Asn Ser Ala Ala Asp Val  
260 265 270

Ala Lys Ala Val Arg Asp Ala Glu Ser Gln Leu Gly Ala Arg Val Ser  
 275 280 285

Gly Ile Val His Ala Ser Gly Val Leu Arg Asp Arg Leu Ile Glu Lys  
 290 295 300

Lys Leu Pro Asp Glu Phe Asp Ala Val Phe Gly Thr Lys Val Thr Gly  
 305 310 315 320

Leu Glu Asn Leu Leu Ala Ala Val Asp Arg Ala Asn Leu Lys His Met  
 325 330 335

Val Leu Phe Ser Ser Leu Ala Gly Phe His Gly Asn Val Gly Gln Ser  
 340 345 350

Asp Tyr Ala Met Ala Asn Glu Ala Leu Asn Lys Met Gly Leu Glu Leu  
 355 360 365

Ala Lys Asp Val Ser Val Lys Ser Ile Cys Phe Gly Pro Trp Asp Gly  
 370 375 380

Gly Met Val Thr Pro Gln Leu Lys Lys Gln Phe Gln Glu Met Gly Val  
 385 390 395 400

Gln Ile Ile Pro Arg Glu Gly Gly Ala Asp Thr Val Ala Arg Ile Val  
 405 410 415

Leu Gly Ser Ser Pro Ala Glu Ile Leu Val Gly Asn Trp Arg Thr Pro  
 420 425 430

Ser Lys Lys Val Gly Ser Asp Thr Ile Thr Leu His Arg Lys Ile Ser  
 435 440 445

Ala Lys Ser Asn Pro Phe Leu Glu Asp His Val Ile Gln Gly Arg Arg  
 450 455 460

Val Leu Pro Met Thr Leu Ala Ile Gly Ser Leu Ala Glu Thr Cys Leu  
 465 470 475 480

Gly Leu Phe Pro Gly Tyr Ser Leu Trp Ala Ile Asp Asp Ala Gln Leu  
 485 490 495

Phe Lys Gly Val Thr Val Asp Gly Asp Val Asn Cys Glu Val Thr Leu  
 500 505 510

Thr Pro Ser Thr Ala Pro Ser Gly Arg Val Asn Val Gln Ala Thr Leu  
 515 520 525

Lys Thr Phe Ser Ser Gly Lys Leu Val Pro Ala Tyr Arg Ala Val Ile  
 530 535 540

Val Leu Ser Asn Gln Gly Ala Pro Pro Ala Asn Ala Thr Met Gln Pro  
545 550 555 560

Pro Ser Leu Asp Ala Asp Pro Ala Leu Gln Gly Ser Val Tyr Asp Gly  
565 570 575

Lys Thr Leu Phe His Gly Pro Ala Phe Arg Gly Ile Asp Asp Val Leu  
580 585 590

Ser Cys Thr Lys Ser Gln Leu Val Ala Lys Cys Ser Ala Val Pro Gly  
595 600 605

Ser Asp Ala Ala Arg Gly Glu Phe Ala Thr Asp Thr Asp Ala His Asp  
610 615 620

Pro Phe Val Asn Asp Leu Ala Phe Gln Ala Met Leu Val Trp Val Arg  
625 630 635 640

Arg Thr Leu Gly Gln Ala Ala Leu Pro Asn Ser Ile Gln Arg Ile Val  
645 650 655

Gln His Arg Pro Val Pro Gln Asp Lys Pro Phe Tyr Ile Thr Leu Arg  
660 665 670

Ser Asn Gln Ser Gly Gly His Ser Gln His Lys His Ala Leu Gln Phe  
675 680 685

His Asn Glu Gln Gly Asp Leu Phe Ile Asp Val Gln Ala Ser Val Ile  
690 695 700

Ala Thr Asp Ser Leu Ala Phe  
705 710

<210> 19  
<211> 1350  
<212> DNA  
<213> Schizochytrium sp.

<220>  
<221> CDS  
<222> (1)..(1350)

<400> 19  
atg gcc gct cgg aat gtg agc gcc gcg cat gag atg cac gat gaa aag 48  
Met Ala Ala Arg Asn Val Ser Ala Ala His Glu Met His Asp Glu Lys  
1 5 10 15  
cgc atc gcc gtc gtc ggc atg gcc gtc cag tac gcc gga tgc aaa acc 96  
Arg Ile Ala Val Val Gly Met Ala Val Gln Tyr Ala Gly Cys Lys Thr  
20 25 30  
aag gac gag ttc tgg gag gtg ctc atg aac gcc aag gtc gag tcc aag 144  
Lys Asp Glu Phe Trp Glu Val Leu Met Asn Gly Lys Val Glu Ser Lys  
35 40 45  
gtg atc agc gac aaa cga ctc ggc tcc aac tac cgc gcc gag cac tac 192

Val	Ile	Ser	Asp	Lys	Arg	Leu	Gly	Ser	Asn	Tyr	Arg	Ala	Glu	His	Tyr	
50						55					60					
aaa	gca	gag	cgc	agc	aag	tat	gcc	gac	acc	ttt	tgc	aac	gaa	acg	tac	240
Lys	Ala	Glu	Arg	Ser	Lys	Tyr	Ala	Asp	Thr	Phe	Cys	Asn	Glu	Thr	Tyr	
65					70					75					80	
ggc	acc	ctt	gac	gag	aac	gag	atc	gac	aac	gag	cac	gaa	ctc	ctc	ctc	288
Gly	Thr	Leu	Asp	Glu	Asn	Glu	Ile	Asp	Asn	Glu	His	Glu	Leu	Leu	Leu	
				85					90					95		
aac	ctc	gcc	aag	cag	gca	ctc	gca	gag	aca	tcc	gtc	aaa	gac	tcg	aca	336
Asn	Leu	Ala	Lys	Gln	Ala	Leu	Ala	Glu	Thr	Ser	Val	Lys	Asp	Ser	Thr	
			100					105					110			
cgc	tgc	ggc	atc	gtc	agc	ggc	tgc	ctc	tcg	ttc	ccc	atg	gac	aac	ctc	384
Arg	Cys	Gly	Ile	Val	Ser	Gly	Cys	Leu	Ser	Phe	Pro	Met	Asp	Asn	Leu	
		115					120					125				
cag	ggt	gaa	ctc	ctc	aac	gtg	tac	caa	aac	cat	gtc	gag	aaa	aag	ctc	432
Gln	Gly	Glu	Leu	Leu	Asn	Val	Tyr	Gln	Asn	His	Val	Glu	Lys	Lys	Leu	
	130					135					140					
ggg	gcc	cgc	gtc	ttc	aag	gac	gcc	tcc	cat	tgg	tcc	gaa	cgc	gag	cag	480
Gly	Ala	Arg	Val	Phe	Lys	Asp	Ala	Ser	His	Trp	Ser	Glu	Arg	Glu	Gln	
145					150					155					160	
tcc	aac	aaa	ccc	gag	gcc	ggt	gac	cgc	cgc	atc	ttc	atg	gac	ccg	gcc	528
Ser	Asn	Lys	Pro	Glu	Ala	Gly	Asp	Arg	Arg	Ile	Phe	Met	Asp	Pro	Ala	
				165					170					175		
tcc	ttc	gtc	gcc	gaa	gaa	ctc	aac	ctc	ggc	gcc	ctt	cac	tac	tcc	gtc	576
Ser	Phe	Val	Ala	Glu	Glu	Leu	Asn	Leu	Gly	Ala	Leu	His	Tyr	Ser	Val	
			180					185					190			
gac	gca	gca	tgc	gcc	acg	gcg	ctc	tac	gtg	ctc	cgc	ctc	gcg	cag	gat	624
Asp	Ala	Ala	Cys	Ala	Thr	Ala	Leu	Tyr	Val	Leu	Arg	Leu	Ala	Gln	Asp	
		195					200					205				
cat	ctc	gtc	tcc	ggc	gcc	gcc	gac	gtc	atg	ctc	tgc	ggt	gcc	acc	tgc	672
His	Leu	Val	Ser	Gly	Ala	Ala	Asp	Val	Met	Leu	Cys	Gly	Ala	Thr	Cys	
	210					215					220					
ctg	ccg	gag	ccc	ttt	ttc	atc	ctt	tcg	ggc	ttt	tcc	acc	ttc	cag	gcc	720
Leu	Pro	Glu	Pro	Phe	Phe	Ile	Leu	Ser	Gly	Phe	Ser	Thr	Phe	Gln	Ala	
225					230					235					240	
atg	ccc	gtc	ggc	acg	ggc	cag	aac	gtg	tcc	atg	ccg	ctg	cac	aag	gac	768
Met	Pro	Val	Gly	Thr	Gly	Gln	Asn	Val	Ser	Met	Pro	Leu	His	Lys	Asp	
				245					250					255		
agc	cag	ggc	ctc	acc	ccg	ggt	gag	ggc	ggc	tcc	atc	atg	gtc	ctc	aag	816
Ser	Gln	Gly	Leu	Thr	Pro	Gly	Glu	Gly	Gly	Ser	Ile	Met	Val	Leu	Lys	
			260					265					270			
cgt	ctc	gat	gat	gcc	atc	cgc	gac	ggc	gac	cac	att	tac	ggc	acc	ctt	864
Arg	Leu	Asp	Asp	Ala	Ile	Arg	Asp	Gly	Asp	His	Ile	Tyr	Gly	Thr	Leu	
		275					280					285				
ctc	ggc	gcc	aat	gtc	agc	aac	tcc	ggc	aca	ggt	ctg	ccc	ctc	aag	ccc	912
Leu	Gly	Ala	Asn	Val	Ser	Asn	Ser	Gly	Thr	Gly	Leu	Pro	Leu	Lys	Pro	
	290					295					300					
ctt	ctc	ccc	agc	gag	aaa	aag	tgc	ctc	atg	gac	acc	tac	acg	cgc	att	960
Leu	Leu	Pro	Ser	Glu	Lys	Lys	Cys	Leu	Met	Asp	Thr	Tyr	Thr	Arg	Ile	
305					310					315					320	
aac	gtg	cac	ccg	cac	aag	att	cag	tac	gtc	gag	tgc	cac	gcc	acc	ggc	1008

Asn	Val	His	Pro	His	Lys	Ile	Gln	Tyr	Val	Glu	Cys	His	Ala	Thr	Gly		
				325					330					335			
acg	ccc	cag	ggt	gat	cgt	gtg	gaa	atc	gac	gcc	gtc	aag	gcc	tgc	ttt	1056	
Thr	Pro	Gln	Gly	Asp	Arg	Val	Glu	Ile	Asp	Ala	Val	Lys	Ala	Cys	Phe		
			340					345					350				
gaa	ggc	aag	gtc	ccc	cgt	ttc	ggt	acc	aca	aag	ggc	aac	ttt	gga	cac	1104	
Glu	Gly	Lys	Val	Pro	Arg	Phe	Gly	Thr	Thr	Lys	Gly	Asn	Phe	Gly	His		
		355					360					365					
acc	cts	gyc	gca	gcc	ggc	ttt	gcc	ggt	atg	tgc	aag	gtc	ctc	ctc	tcc	1152	
Thr	Xaa	Xaa	Ala	Ala	Gly	Phe	Ala	Gly	Met	Cys	Lys	Val	Leu	Leu	Ser		
	370					375					380						
atg	aag	cat	ggc	atc	atc	ccg	ccc	acc	ccg	ggt	atc	gat	gac	gag	acc	1200	
Met	Lys	His	Gly	Ile	Ile	Pro	Pro	Thr	Pro	Gly	Ile	Asp	Asp	Glu	Thr		
	385				390					395				400			
aag	atg	gac	cct	ctc	gtc	gtc	tcc	ggt	gag	gcc	atc	cca	tgg	cca	gag	1248	
Lys	Met	Asp	Pro	Leu	Val	Val	Ser	Gly	Glu	Ala	Ile	Pro	Trp	Pro	Glu		
			405						410					415			
acc	aac	ggc	gag	ccc	aag	cgc	gcc	ggt	ctc	tgc	gcc	ttt	ggc	ttt	ggt	1296	
Thr	Asn	Gly	Glu	Pro	Lys	Arg	Ala	Gly	Leu	Ser	Ala	Phe	Gly	Phe	Gly		
		420					425					430					
ggc	acc	aac	gcc	cat	gcc	gtc	ttt	gag	gag	cat	gac	ccc	tcc	aac	gcc	1344	
Gly	Thr	Asn	Ala	His	Ala	Val	Phe	Glu	Glu	His	Asp	Pro	Ser	Asn	Ala		
		435				440						445					
gcc	tgc															1350	
Ala	Cys																
	450																

<210> 20  
 <211> 450  
 <212> PRT  
 <213> Schizochytrium sp.

<220>  
 <221> misc\_feature  
 <222> (370)..(370)  
 <223> The 'Xaa' at location 370 stands for Leu.

<220>  
 <221> misc\_feature  
 <222> (371)..(371)  
 <223> The 'Xaa' at location 371 stands for Ala, or Val.

<400> 20

Met	Ala	Ala	Arg	Asn	Val	Ser	Ala	Ala	His	Glu	Met	His	Asp	Glu	Lys
1				5					10					15	

Arg	Ile	Ala	Val	Val	Gly	Met	Ala	Val	Gln	Tyr	Ala	Gly	Cys	Lys	Thr
		20					25					30			

Lys	Asp	Glu	Phe	Trp	Glu	Val	Leu	Met	Asn	Gly	Lys	Val	Glu	Ser	Lys
	35						40					45			

Val	Ile	Ser	Asp	Lys	Arg	Leu	Gly	Ser	Asn	Tyr	Arg	Ala	Glu	His	Tyr
	50					55				60					

Lys Ala Glu Arg Ser Lys Tyr Ala Asp Thr Phe Cys Asn Glu Thr Tyr  
 65 70 75 80  
 Gly Thr Leu Asp Glu Asn Glu Ile Asp Asn Glu His Glu Leu Leu Leu  
 85 90 95  
 Asn Leu Ala Lys Gln Ala Leu Ala Glu Thr Ser Val Lys Asp Ser Thr  
 100 105 110  
 Arg Cys Gly Ile Val Ser Gly Cys Leu Ser Phe Pro Met Asp Asn Leu  
 115 120 125  
 Gln Gly Glu Leu Leu Asn Val Tyr Gln Asn His Val Glu Lys Lys Leu  
 130 135 140  
 Gly Ala Arg Val Phe Lys Asp Ala Ser His Trp Ser Glu Arg Glu Gln  
 145 150 155 160  
 Ser Asn Lys Pro Glu Ala Gly Asp Arg Arg Ile Phe Met Asp Pro Ala  
 165 170 175  
 Ser Phe Val Ala Glu Glu Leu Asn Leu Gly Ala Leu His Tyr Ser Val  
 180 185 190  
 Asp Ala Ala Cys Ala Thr Ala Leu Tyr Val Leu Arg Leu Ala Gln Asp  
 195 200 205  
 His Leu Val Ser Gly Ala Ala Asp Val Met Leu Cys Gly Ala Thr Cys  
 210 215 220  
 Leu Pro Glu Pro Phe Phe Ile Leu Ser Gly Phe Ser Thr Phe Gln Ala  
 225 230 235 240  
 Met Pro Val Gly Thr Gly Gln Asn Val Ser Met Pro Leu His Lys Asp  
 245 250 255  
 Ser Gln Gly Leu Thr Pro Gly Glu Gly Gly Ser Ile Met Val Leu Lys  
 260 265 270  
 Arg Leu Asp Asp Ala Ile Arg Asp Gly Asp His Ile Tyr Gly Thr Leu  
 275 280 285  
 Leu Gly Ala Asn Val Ser Asn Ser Gly Thr Gly Leu Pro Leu Lys Pro  
 290 295 300  
 Leu Leu Pro Ser Glu Lys Lys Cys Leu Met Asp Thr Tyr Thr Arg Ile  
 305 310 315 320  
 Asn Val His Pro His Lys Ile Gln Tyr Val Glu Cys His Ala Thr Gly  
 325 330 335



Thr Pro Gln Gly Asp Arg Val Glu Ile Asp Ala Val Lys Ala Cys Phe  
 340 345 350

Glu Gly Lys Val Pro Arg Phe Gly Thr Thr Lys Gly Asn Phe Gly His  
 355 360 365

Thr Xaa Xaa Ala Ala Gly Phe Ala Gly Met Cys Lys Val Leu Leu Ser  
 370 375 380

Met Lys His Gly Ile Ile Pro Pro Thr Pro Gly Ile Asp Asp Glu Thr  
 385 390 395 400

Lys Met Asp Pro Leu Val Val Ser Gly Glu Ala Ile Pro Trp Pro Glu  
 405 410 415

Thr Asn Gly Glu Pro Lys Arg Ala Gly Leu Ser Ala Phe Gly Phe Gly  
 420 425 430

Gly Thr Asn Ala His Ala Val Phe Glu Glu His Asp Pro Ser Asn Ala  
 435 440 445

Ala Cys  
 450

<210> 21  
 <211> 1323  
 <212> DNA  
 <213> Schizochytrium sp.

<220>  
 <221> CDS  
 <222> (1)..(1323)

<400> 21  
 tcg gcc cgc tgc ggc ggt gaa agc aac atg cgc atc gcc atc act ggt 48  
 Ser Ala Arg Cys Gly Gly Glu Ser Asn Met Arg Ile Ala Ile Thr Gly  
 1 5 10 15  
 atg gac gcc acc ttt ggc gct ctc aag gga ctc gac gcc ttc gag cgc 96  
 Met Asp Ala Thr Phe Gly Ala Leu Lys Gly Leu Asp Ala Phe Glu Arg  
 20 25 30  
 gcc att tac acc ggc gct cac ggt gcc atc cca ctc cca gaa aag cgc 144  
 Ala Ile Tyr Thr Gly Ala His Gly Ala Ile Pro Leu Pro Glu Lys Arg  
 35 40 45  
 tgg cgc ttt ctc ggc aag gac aag gac ttt ctt gac ctc tgc ggc gtc 192  
 Trp Arg Phe Leu Gly Lys Asp Lys Asp Phe Leu Asp Leu Cys Gly Val  
 50 55 60  
 aag gcc acc ccg cac ggc tgc tac att gaa gat gtt gag gtc gac ttc 240  
 Lys Ala Thr Pro His Gly Cys Tyr Ile Glu Asp Val Glu Val Asp Phe  
 65 70 75 80  
 cag cgc ctc cgc acg ccc atg acc cct gaa gac atg ctc ctc cct cag 288  
 Gln Arg Leu Arg Thr Pro Met Thr Pro Glu Asp Met Leu Leu Pro Gln  
 85 90 95  
 cag ctt ctg gcc gtc acc acc att gac cgc gcc atc ctc gac tcg gga 336

Gln	Leu	Leu	Ala	Val	Thr	Thr	Ile	Asp	Arg	Ala	Ile	Leu	Asp	Ser	Gly	
			100					105					110			
atg	aaa	aag	ggt	ggc	aat	gtc	gcc	gtc	ttt	gtc	ggc	ctc	ggc	acc	gac	384
Met	Lys	Lys	Gly	Gly	Asn	Val	Ala	Val	Phe	Val	Gly	Leu	Gly	Thr	Asp	
		115					120					125				
ctc	gag	ctc	tac	cgt	cac	cgt	gct	cgc	gtc	gct	ctc	aag	gag	cgc	gtc	432
Leu	Glu	Leu	Tyr	Arg	His	Arg	Ala	Arg	Val	Ala	Leu	Lys	Glu	Arg	Val	
	130					135					140					
cgc	cct	gaa	gcc	tcc	aag	aag	ctc	aat	gac	atg	atg	cag	tac	att	aac	480
Arg	Pro	Glu	Ala	Ser	Lys	Lys	Leu	Asn	Asp	Met	Met	Gln	Tyr	Ile	Asn	
145					150					155					160	
gac	tgc	ggc	aca	tcc	aca	tcg	tac	acc	tcg	tac	att	ggc	aac	ctc	gtc	528
Asp	Cys	Gly	Thr	Ser	Thr	Ser	Tyr	Thr	Ser	Tyr	Ile	Gly	Asn	Leu	Val	
				165					170					175		
gcc	acg	cgc	gtc	tcg	tcg	cag	tgg	ggc	ttc	acg	ggc	ccc	tcc	ttt	acg	576
Ala	Thr	Arg	Val	Ser	Ser	Gln	Trp	Gly	Phe	Thr	Gly	Pro	Ser	Phe	Thr	
			180					185					190			
atc	acc	gag	ggc	aac	aac	tcc	gtc	tac	cgc	tgc	gcc	gag	ctc	ggc	aag	624
Ile	Thr	Glu	Gly	Asn	Asn	Ser	Val	Tyr	Arg	Cys	Ala	Glu	Leu	Gly	Lys	
		195					200					205				
tac	ctc	ctc	gag	acc	ggc	gag	gtc	gat	ggc	gtc	gtc	gtt	gcg	ggc	gtc	672
Tyr	Leu	Leu	Glu	Thr	Gly	Glu	Val	Asp	Gly	Val	Val	Val	Ala	Gly	Val	
	210					215					220					
gat	ctc	tgc	ggc	agt	gcc	gaa	aac	ctt	tac	gtc	aag	tct	cgc	cgc	ttc	720
Asp	Leu	Cys	Gly	Ser	Ala	Glu	Asn	Leu	Tyr	Val	Lys	Ser	Arg	Arg	Phe	
225				230						235					240	
aag	gtg	tcc	acc	tcc	gat	acc	ccg	cgc	gcc	agc	ttt	gac	gcc	gcc	gcc	768
Lys	Val	Ser	Thr	Ser	Asp	Thr	Pro	Arg	Ala	Ser	Phe	Asp	Ala	Ala	Ala	
				245					250				255			
gat	ggc	tac	ttt	gtc	ggc	gag	ggc	tgc	ggc	gcc	ttt	gtg	ctc	aag	cgt	816
Asp	Gly	Tyr	Phe	Val	Gly	Glu	Gly	Cys	Gly	Ala	Phe	Val	Leu	Lys	Arg	
			260				265						270			
gag	act	agc	tgc	acc	aag	gac	gac	cgt	atc	tac	gct	tgc	atg	gat	gcc	864
Glu	Thr	Ser	Cys	Thr	Lys	Asp	Asp	Arg	Ile	Tyr	Ala	Cys	Met	Asp	Ala	
		275					280					285				
atc	gtc	cct	ggc	aac	gtc	cct	agc	gcc	tgc	ttg	cgc	gag	gcc	ctc	gac	912
Ile	Val	Pro	Gly	Asn	Val	Pro	Ser	Ala	Cys	Leu	Arg	Glu	Ala	Leu	Asp	
	290					295					300					
cag	gcg	cgc	gtc	aag	ccg	ggc	gat	atc	gag	atg	ctc	gag	ctc	agc	gcc	960
Gln	Ala	Arg	Val	Lys	Pro	Gly	Asp	Ile	Glu	Met	Leu	Glu	Leu	Ser	Ala	
305					310					315					320	
gac	tcc	gcc	cgc	cac	ctc	aag	gac	ccg	tcc	gtc	ctg	ccc	aag	gag	ctc	1008
Asp	Ser	Ala	Arg	His	Leu	Lys	Asp	Pro	Ser	Val	Leu	Pro	Lys	Glu	Leu	
				325					330				335			
act	gcc	gag	gag	gaa	atc	ggc	ggc	ctt	cag	acg	atc	ctt	cgt	gac	gat	1056
Thr	Ala	Glu	Glu	Glu	Ile	Gly	Gly	Leu	Gln	Thr	Ile	Leu	Arg	Asp	Asp	
			340				345						350			
gac	aag	ctc	ccg	cgc	aac	gtc	gca	acg	ggc	agt	gtc	aag	gcc	acc	gtc	1104
Asp	Lys	Leu	Pro	Arg	Asn	Val	Ala	Thr	Gly	Ser	Val	Lys	Ala	Thr	Val	
		355					360					365				
ggc	gac	acc	ggc	tat	gcc	tct	ggc	gct	gcc	agc	ctc	atc	aag	gct	gcg	1152

Gly Asp Thr Gly Tyr Ala Ser Gly Ala Ala Ser Leu Ile Lys Ala Ala  
 370 375 380  
 ctt tgc atc tac aac cgc tac ctg ccc agc aac ggc gac gac tgg gat 1200  
 Leu Cys Ile Tyr Asn Arg Tyr Leu Pro Ser Asn Gly Asp Asp Trp Asp  
 385 390 395 400  
 gaa ccc gcc cct gag gcg ccc tgg gac agc acc ctc ttt gcg tgc cag 1248  
 Glu Pro Ala Pro Glu Ala Pro Trp Asp Ser Thr Leu Phe Ala Cys Gln  
 405 410 415  
 acc tcg cgc gct tgg ctc aag aac cct ggc gag cgt cgc tat gcg gcc 1296  
 Thr Ser Arg Ala Trp Leu Lys Asn Pro Gly Glu Arg Arg Tyr Ala Ala  
 420 425 430  
 gtc tcg ggc gtc tcc gag acg cgc tcg 1323  
 Val Ser Gly Val Ser Glu Thr Arg Ser  
 435 440

<210> 22  
 <211> 441  
 <212> PRT  
 <213> Schizochytrium sp.

<400> 22

Ser Ala Arg Cys Gly Gly Glu Ser Asn Met Arg Ile Ala Ile Thr Gly  
 1 5 10 15

Met Asp Ala Thr Phe Gly Ala Leu Lys Gly Leu Asp Ala Phe Glu Arg  
 20 25 30

Ala Ile Tyr Thr Gly Ala His Gly Ala Ile Pro Leu Pro Glu Lys Arg  
 35 40 45

Trp Arg Phe Leu Gly Lys Asp Lys Asp Phe Leu Asp Leu Cys Gly Val  
 50 55 60

Lys Ala Thr Pro His Gly Cys Tyr Ile Glu Asp Val Glu Val Asp Phe  
 65 70 75 80

Gln Arg Leu Arg Thr Pro Met Thr Pro Glu Asp Met Leu Leu Pro Gln  
 85 90 95

Gln Leu Leu Ala Val Thr Thr Ile Asp Arg Ala Ile Leu Asp Ser Gly  
 100 105 110

Met Lys Lys Gly Gly Asn Val Ala Val Phe Val Gly Leu Gly Thr Asp  
 115 120 125

Leu Glu Leu Tyr Arg His Arg Ala Arg Val Ala Leu Lys Glu Arg Val  
 130 135 140

Arg Pro Glu Ala Ser Lys Lys Leu Asn Asp Met Met Gln Tyr Ile Asn  
 145 150 155 160

Asp Cys Gly Thr Ser Thr Ser Tyr Thr Ser Tyr Ile Gly Asn Leu Val

165										170					175				
Ala	Thr	Arg	Val 180	Ser	Ser	Gln	Trp	Gly 185	Phe	Thr	Gly	Pro	Ser 190	Phe	Thr				
Ile	Thr	Glu 195	Gly	Asn	Asn	Ser	Val 200	Tyr	Arg	Cys	Ala	Glu 205	Leu	Gly	Lys				
Tyr	Leu 210	Leu	Glu	Thr	Gly	Glu 215	Val	Asp	Gly	Val	Val 220	Val	Ala	Gly	Val				
Asp 225	Leu	Cys	Gly	Ser	Ala 230	Glu	Asn	Leu	Tyr	Val 235	Lys	Ser	Arg	Arg	Phe 240				
Lys	Val	Ser	Thr	Ser 245	Asp	Thr	Pro	Arg	Ala 250	Ser	Phe	Asp	Ala	Ala 255	Ala				
Asp	Gly	Tyr	Phe 260	Val	Gly	Glu	Gly	Cys 265	Gly	Ala	Phe	Val	Leu 270	Lys	Arg				
Glu	Thr	Ser 275	Cys	Thr	Lys	Asp	Asp 280	Arg	Ile	Tyr	Ala	Cys 285	Met	Asp	Ala				
Ile	Val 290	Pro	Gly	Asn	Val	Pro 295	Ser	Ala	Cys	Leu	Arg 300	Glu	Ala	Leu	Asp				
Gln 305	Ala	Arg	Val	Lys	Pro 310	Gly	Asp	Ile	Glu	Met 315	Leu	Glu	Leu	Ser	Ala 320				
Asp	Ser	Ala	Arg	His 325	Leu	Lys	Asp	Pro	Ser 330	Val	Leu	Pro	Lys	Glu 335	Leu				
Thr	Ala	Glu	Glu 340	Glu	Ile	Gly	Gly	Leu 345	Gln	Thr	Ile	Leu	Arg 350	Asp	Asp				
Asp	Lys	Leu 355	Pro	Arg	Asn	Val	Ala 360	Thr	Gly	Ser	Val	Lys 365	Ala	Thr	Val				
Gly 370	Asp	Thr	Gly	Tyr	Ala	Ser 375	Gly	Ala	Ala	Ser	Leu 380	Ile	Lys	Ala	Ala				
Leu 385	Cys	Ile	Tyr	Asn	Arg 390	Tyr	Leu	Pro	Ser	Asn 395	Gly	Asp	Asp	Trp	Asp 400				
Glu	Pro	Ala	Pro	Glu 405	Ala	Pro	Trp	Asp	Ser 410	Thr	Leu	Phe	Ala	Cys 415	Gln				
Thr	Ser	Arg	Ala 420	Trp	Leu	Lys	Asn	Pro 425	Gly	Glu	Arg	Arg	Tyr 430	Ala	Ala				
Val	Ser	Gly	Val	Ser	Glu	Thr	Arg	Ser											

435

440

<210> 23  
 <211> 1500  
 <212> DNA  
 <213> Schizochytrium sp.

<220>  
 <221> CDS  
 <222> (1)..(1500)

<400> 23

tgc tat tcc gtg ctc ctc tcc gaa gcc gag ggc cac tac gag cgc gag	48
Cys Tyr Ser Val Leu Leu Ser Glu Ala Glu Gly His Tyr Glu Arg Glu	
1 5 10 15	
aac cgc atc tcg ctc gac gag gag gcg ccc aag ctc att gtg ctt cgc	96
Asn Arg Ile Ser Leu Asp Glu Glu Ala Pro Lys Leu Ile Val Leu Arg	
20 25 30	
gcc gac tcc cac gag gag atc ctt ggt cgc ctc gac aag atc cgc gag	144
Ala Asp Ser His Glu Glu Ile Leu Gly Arg Leu Asp Lys Ile Arg Glu	
35 40 45	
cgc ttc ttg cag ccc acg ggc gcc gcc ccg cgc gag tcc gag ctc aag	192
Arg Phe Leu Gln Pro Thr Gly Ala Ala Pro Arg Glu Ser Glu Leu Lys	
50 55 60	
gcg cag gcc cgc cgc atc ttc ctc gag ctc ctc ggc gag acc ctt gcc	240
Ala Gln Ala Arg Arg Ile Phe Leu Glu Leu Leu Gly Glu Thr Leu Ala	
65 70 75 80	
cag gat gcc gct tct tca ggc tcg caa aag ccc ctc gct ctc agc ctc	288
Gln Asp Ala Ala Ser Ser Gly Ser Gln Lys Pro Leu Ala Leu Ser Leu	
85 90 95	
gtc tcc acg ccc tcc aag ctc cag cgc gag gtc gag ctc gcg gcc aag	336
Val Ser Thr Pro Ser Lys Leu Gln Arg Glu Val Glu Leu Ala Ala Lys	
100 105 110	
ggc atc ccg cgc tgc ctc aag atg cgc cgc gat tgg agc tcc cct gct	384
Gly Ile Pro Arg Cys Leu Lys Met Arg Arg Asp Trp Ser Ser Pro Ala	
115 120 125	
ggc agc cgc tac gcg cct gag ccg ctc gcc agc gac cgc gtc gcc ttc	432
Gly Ser Arg Tyr Ala Pro Glu Pro Leu Ala Ser Asp Arg Val Ala Phe	
130 135 140	
atg tac ggc gaa ggt cgc agc cct tac tac ggc atc acc caa gac att	480
Met Tyr Gly Glu Gly Arg Ser Pro Tyr Tyr Gly Ile Thr Gln Asp Ile	
145 150 155 160	
cac cgc att tgg ccc gaa ctc cac gag gtc atc aac gaa aag acg aac	528
His Arg Ile Trp Pro Glu Leu His Glu Val Ile Asn Glu Lys Thr Asn	
165 170 175	
cgt ctc tgg gcc gaa ggc gac cgc tgg gtc atg ccg cgc gcc agc ttc	576
Arg Leu Trp Ala Glu Gly Asp Arg Trp Val Met Pro Arg Ala Ser Phe	
180 185 190	
aag tcg gag ctc gag agc cag cag caa gag ttt gat cgc aac atg att	624
Lys Ser Glu Leu Glu Ser Gln Gln Glu Phe Asp Arg Asn Met Ile	
195 200 205	
gaa atg ttc cgt ctt gga atc ctc acc tca att gcc ttc acc aat ctg	672
Glu Met Phe Arg Leu Gly Ile Leu Thr Ser Ile Ala Phe Thr Asn Leu	

210	215	220	
gcg cgc gac gtt ctc aac atc acg ccc aag gcc gcc ttt ggc ctc agt Ala Arg Asp Val Leu Asn Ile Thr Pro Lys Ala Ala Phe Gly Leu Ser 225 230 235 240			720
ctt ggc gag att tcc atg att ttt gcc ttt tcc aag aag aac ggt ctc Leu Gly Glu Ile Ser Met Ile Phe Ala Phe Ser Lys Lys Asn Gly Leu 245 250 255			768
atc tcc gac cag ctc acc aag gat ctt cgc gag tcc gac gtg tgg aac Ile Ser Asp Gln Leu Thr Lys Asp Leu Arg Glu Ser Asp Val Trp Asn 260 265 270			816
aag gct ctg gcc gtt gaa ttt aat gcg ctg cgc gag gcc tgg ggc att Lys Ala Leu Ala Val Glu Phe Asn Ala Leu Arg Glu Ala Trp Gly Ile 275 280 285			864
cca cag agt gtc ccc aag gac gag ttc tgg caa ggc tac att gtg cgc Pro Gln Ser Val Pro Lys Asp Glu Phe Trp Gln Gly Tyr Ile Val Arg 290 295 300			912
ggc acc aag cag gat atc gag gcg gcc atc gcc ccg gac agc aag tac Gly Thr Lys Gln Asp Ile Glu Ala Ala Ile Ala Pro Asp Ser Lys Tyr 305 310 315 320			960
gtg cgc ctc acc atc atc aat gat gcc aac acc gcc ctc att agc ggc Val Arg Leu Thr Ile Ile Asn Asp Ala Asn Thr Ala Leu Ile Ser Gly 325 330 335			1008
aag ccc gac gcc tgc aag gct gcg atc gcg cgt ctc ggt ggc aac att Lys Pro Asp Ala Cys Lys Ala Ala Ile Ala Arg Leu Gly Gly Asn Ile 340 345 350			1056
cct gcg ctt ccc gtg acc cag ggc atg tgc ggc cac tgc ccc gag gtg Pro Ala Leu Pro Val Thr Gln Gly Met Cys Gly His Cys Pro Glu Val 355 360 365			1104
gga cct tat acc aag gat atc gcc aag atc cat gcc aac ctt gag ttc Gly Pro Tyr Thr Lys Asp Ile Ala Lys Ile His Ala Asn Leu Glu Phe 370 375 380			1152
ccc gtt gtc gac ggc ctt gac ctc tgg acc aca atc aac cag aag cgc Pro Val Val Asp Gly Leu Asp Leu Trp Thr Thr Ile Asn Gln Lys Arg 385 390 395 400			1200
ctc gtg cca cgc gcc acg ggc gcc aag gac gaa tgg gcc cct tct tcc Leu Val Pro Arg Ala Thr Gly Ala Lys Asp Glu Trp Ala Pro Ser Ser 405 410 415			1248
ttt ggc gag tac gcc ggc cag ctc tac gag aag cag gct aac ttc ccc Phe Gly Glu Tyr Ala Gly Gln Leu Tyr Glu Lys Gln Ala Asn Phe Pro 420 425 430			1296
caa atc gtc gag acc att tac aag caa aac tac gac gtc ttt gtc gag Gln Ile Val Glu Thr Ile Tyr Lys Gln Asn Tyr Asp Val Phe Val Glu 435 440 445			1344
gtt ggg ccc aac aac cac cgt agc acc gca gtg cgc acc acg ctt ggt Val Gly Pro Asn Asn His Arg Ser Thr Ala Val Arg Thr Thr Leu Gly 450 455 460			1392
ccc cag cgc aac cac ctt gct ggc gcc atc gac aag cag aac gag gat Pro Gln Arg Asn His Leu Ala Gly Ala Ile Asp Lys Gln Asn Glu Asp 465 470 475 480			1440
gct tgg acg acc atc gtc aag ctt gtg gct tgc ctc aag gcc cac ctt Ala Trp Thr Thr Ile Val Lys Leu Val Ala Ser Leu Lys Ala His Leu 485 490 495			1488

485                      490                      495                      1500  
 gtt cct ggc gtc  
 Val Pro Gly Val  
 500  
  
 <210> 24  
 <211> 500  
 <212> PRT  
 <213> Schizochytrium sp.  
  
 <400> 24  
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 1                      5                      10                      15  
  
 Asn Arg Ile Ser Leu Asp Glu Glu Ala Pro Lys Leu Ile Val Leu Arg  
 20                      25                      30  
  
 Ala Asp Ser His Glu Glu Ile Leu Gly Arg Leu Asp Lys Ile Arg Glu  
 35                      40                      45  
  
 Arg Phe Leu Gln Pro Thr Gly Ala Ala Pro Arg Glu Ser Glu Leu Lys  
 50                      55                      60  
  
 Ala Gln Ala Arg Arg Ile Phe Leu Glu Leu Leu Gly Glu Thr Leu Ala  
 65                      70                      75                      80  
  
 Gln Asp Ala Ala Ser Ser Gly Ser Gln Lys Pro Leu Ala Leu Ser Leu  
 85                      90                      95  
  
 Val Ser Thr Pro Ser Lys Leu Gln Arg Glu Val Glu Leu Ala Ala Lys  
 100                      105                      110  
  
 Gly Ile Pro Arg Cys Leu Lys Met Arg Arg Asp Trp Ser Ser Pro Ala  
 115                      120                      125  
  
 Gly Ser Arg Tyr Ala Pro Glu Pro Leu Ala Ser Asp Arg Val Ala Phe  
 130                      135                      140  
  
 Met Tyr Gly Glu Gly Arg Ser Pro Tyr Tyr Gly Ile Thr Gln Asp Ile  
 145                      150                      155                      160  
  
 His Arg Ile Trp Pro Glu Leu His Glu Val Ile Asn Glu Lys Thr Asn  
 165                      170                      175  
  
 Arg Leu Trp Ala Glu Gly Asp Arg Trp Val Met Pro Arg Ala Ser Phe  
 180                      185                      190  
  
 Lys Ser Glu Leu Glu Ser Gln Gln Gln Glu Phe Asp Arg Asn Met Ile  
 195                      200                      205  
  
 Glu Met Phe Arg Leu Gly Ile Leu Thr Ser Ile Ala Phe Thr Asn Leu  
 210                      215                      220

Ala Arg Asp Val Leu Asn Ile Thr Pro Lys Ala Ala Phe Gly Leu Ser  
 225 230 235 240

Leu Gly Glu Ile Ser Met Ile Phe Ala Phe Ser Lys Lys Asn Gly Leu  
 245 250 255

Ile Ser Asp Gln Leu Thr Lys Asp Leu Arg Glu Ser Asp Val Trp Asn  
 260 265 270

Lys Ala Leu Ala Val Glu Phe Asn Ala Leu Arg Glu Ala Trp Gly Ile  
 275 280 285

Pro Gln Ser Val Pro Lys Asp Glu Phe Trp Gln Gly Tyr Ile Val Arg  
 290 295 300

Gly Thr Lys Gln Asp Ile Glu Ala Ala Ile Ala Pro Asp Ser Lys Tyr  
 305 310 315 320

Val Arg Leu Thr Ile Ile Asn Asp Ala Asn Thr Ala Leu Ile Ser Gly  
 325 330 335

Lys Pro Asp Ala Cys Lys Ala Ala Ile Ala Arg Leu Gly Gly Asn Ile  
 340 345 350

Pro Ala Leu Pro Val Thr Gln Gly Met Cys Gly His Cys Pro Glu Val  
 355 360 365

Gly Pro Tyr Thr Lys Asp Ile Ala Lys Ile His Ala Asn Leu Glu Phe  
 370 375 380

Pro Val Val Asp Gly Leu Asp Leu Trp Thr Thr Ile Asn Gln Lys Arg  
 385 390 395 400

Leu Val Pro Arg Ala Thr Gly Ala Lys Asp Glu Trp Ala Pro Ser Ser  
 405 410 415

Phe Gly Glu Tyr Ala Gly Gln Leu Tyr Glu Lys Gln Ala Asn Phe Pro  
 420 425 430

Gln Ile Val Glu Thr Ile Tyr Lys Gln Asn Tyr Asp Val Phe Val Glu  
 435 440 445

Val Gly Pro Asn Asn His Arg Ser Thr Ala Val Arg Thr Thr Leu Gly  
 450 455 460

Pro Gln Arg Asn His Leu Ala Gly Ala Ile Asp Lys Gln Asn Glu Asp  
 465 470 475 480

Ala Trp Thr Thr Ile Val Lys Leu Val Ala Ser Leu Lys Ala His Leu  
 485 490 495



Val Pro Gly Val  
500

<210> 25  
<211> 1530  
<212> DNA  
<213> Schizochytrium sp.

<220>  
<221> CDS  
<222> (1)..(1530)

<400> 25  
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Leu Leu Asp Leu Asp Ser Met Leu Ala Leu Ser Ser Ala Ser Ala Ser  
1 5 10 15

ggc aac ctt gtt gag act gcg cct agc gac gcc tcg gtc att gtg ccg 96  
Gly Asn Leu Val Glu Thr Ala Pro Ser Asp Ala Ser Val Ile Val Pro  
20 25 30

ccc tgc aac att gcg gat ctc ggc agc cgc gcc ttc atg aaa acg tac 144  
Pro Cys Asn Ile Ala Asp Leu Gly Ser Arg Ala Phe Met Lys Thr Tyr  
35 40 45

ggc gtt tcg gcg cct ctg tac acg ggc gcc atg gcc aag gcc att gcc 192  
Gly Val Ser Ala Pro Leu Tyr Thr Gly Ala Met Ala Lys Gly Ile Ala  
50 55 60

tct gcg gac ctc gtc att gcc gcc ggc cgc cag gcc atc ctt gcg tcc 240  
Ser Ala Asp Leu Val Ile Ala Ala Gly Arg Gln Gly Ile Leu Ala Ser  
65 70 75 80

ttt ggc gcc ggc gga ctt ccc atg cag gtt gtg cgt gag tcc atc gaa 288  
Phe Gly Ala Gly Gly Leu Pro Met Gln Val Val Arg Glu Ser Ile Glu  
85 90 95

aag att cag gcc gcc ctg ccc aat ggc ccg tac gct gtc aac ctt atc 336  
Lys Ile Gln Ala Ala Leu Pro Asn Gly Pro Tyr Ala Val Asn Leu Ile  
100 105 110

cat tct ccc ttt gac agc aac ctc gaa aag ggc aat gtc gat ctc ttc 384  
His Ser Pro Phe Asp Ser Asn Leu Glu Lys Gly Asn Val Asp Leu Phe  
115 120 125

ctc gag aag ggt gtc acc ttt gtc gag gcc tcg gcc ttt atg acg ctc 432  
Leu Glu Lys Gly Val Thr Phe Val Glu Ala Ser Ala Phe Met Thr Leu  
130 135 140

acc ccg cag gtc gtg cgg tac cgc gcg gct ggc ctc acg cgc aac gcc 480  
Thr Pro Gln Val Val Arg Tyr Arg Ala Ala Gly Leu Thr Arg Asn Ala  
145 150 155 160

gac ggc tcg gtc aac atc cgc aac cgt atc att ggc aag gtc tcg cgc 528  
Asp Gly Ser Val Asn Ile Arg Asn Arg Ile Ile Gly Lys Val Ser Arg  
165 170 175

acc gag ctc gcc gag atg ttc atg cgt cct gcg ccc gag cac ctt ctt 576  
Thr Glu Leu Ala Glu Met Phe Met Arg Pro Ala Pro Glu His Leu Leu  
180 185 190

cag aag ctc att gct tcc ggc gag atc aac cag gag cag gcc gag ctc 624  
Gln Lys Leu Ile Ala Ser Gly Glu Ile Asn Gln Glu Gln Ala Glu Leu  
195 200 205

gcc cgc cgt gtt ccc gtc gct gac gac atc gcg gtc gaa gct gac tcg 672

Ala Arg Arg Val Pro Val	Ala Asp Asp Ile Ala Val Glu Ala Asp Ser	
210	215 220	
ggt ggc cac acc gac aac cgc ccc atc cac gtc att ctg ccc ctc atc		720
Gly Gly His Thr Asp Asn Arg Pro Ile His Val Ile Leu Pro Leu Ile		
225 230 235 240		
atc aac ctt cgc gac cgc ctt cac cgc gag tgc ggc tac ccg gcc aac		768
Ile Asn Leu Arg Asp Arg Leu His Arg Glu Cys Gly Tyr Pro Ala Asn		
245 250 255		
ctt cgc gtc cgt gtg ggc gcc ggc ggt ggc att ggg tgc ccc cag gcg		816
Leu Arg Val Arg Val Gly Ala Gly Gly Ile Gly Cys Pro Gln Ala		
260 265 270		
gcg ctg gcc acc ttc aac atg ggt gcc tcc ttt att gtc acc ggc acc		864
Ala Leu Ala Thr Phe Asn Met Gly Ala Ser Phe Ile Val Thr Gly Thr		
275 280 285		
gtg aac cag gtc gcc aag cag tcg ggc acg tgc gac aat gtg cgc aag		912
Val Asn Gln Val Ala Lys Gln Ser Gly Thr Cys Asp Asn Val Arg Lys		
290 295 300		
cag ctc gcg aag gcc act tac tcg gac gta tgc atg gcc ccg gct gcc		960
Gln Leu Ala Lys Ala Thr Tyr Ser Asp Val Cys Met Ala Pro Ala Ala		
305 310 315 320		
gac atg ttc gag gaa ggc gtc aag ctt cag gtc ctc aag aag gga acc		1008
Asp Met Phe Glu Glu Gly Val Lys Leu Gln Val Leu Lys Lys Gly Thr		
325 330 335		
atg ttt ccc tcg cgc gcc aac aag ctc tac gag ctc ttt tgc aag tac		1056
Met Phe Pro Ser Arg Ala Asn Lys Leu Tyr Glu Leu Phe Cys Lys Tyr		
340 345 350		
gac tcg ttc gag tcc atg ccc ccc gca gag ctt gcg cgc gtc gag aag		1104
Asp Ser Phe Glu Ser Met Pro Pro Ala Glu Leu Ala Arg Val Glu Lys		
355 360 365		
cgc atc ttc agc cgc gcg ctc gaa gag gtc tgg gac gag acc aaa aac		1152
Arg Ile Phe Ser Arg Ala Leu Glu Glu Val Trp Asp Glu Thr Lys Asn		
370 375 380		
ttt tac att aac cgt ctt cac aac ccg gag aag atc cag cgc gcc gag		1200
Phe Tyr Ile Asn Arg Leu His Asn Pro Glu Lys Ile Gln Arg Ala Glu		
385 390 395 400		
cgc gac ccc aag ctc aag atg tcg ctg tgc ttt cgc tgg tac ctg agc		1248
Arg Asp Pro Lys Leu Lys Met Ser Leu Cys Phe Arg Trp Tyr Leu Ser		
405 410 415		
ctg gcg agc cgc tgg gcc aac act gga gct tcc gat cgc gtc atg gac		1296
Leu Ala Ser Arg Trp Ala Asn Thr Gly Ala Ser Asp Arg Val Met Asp		
420 425 430		
tac cag gtc tgg tgc ggt cct gcc att ggt tcc ttc aac gat ttc atc		1344
Tyr Gln Val Trp Cys Gly Pro Ala Ile Gly Ser Phe Asn Asp Phe Ile		
435 440 445		
aag gga act tac ctt gat ccg gcc gtc gca aac gag tac ccg tgc gtc		1392
Lys Gly Thr Tyr Leu Asp Pro Ala Val Ala Asn Glu Tyr Pro Cys Val		
450 455 460		
gtt cag att aac aag cag atc ctt cgt gga gcg tgc ttc ttg cgc cgt		1440
Val Gln Ile Asn Lys Gln Ile Leu Arg Gly Ala Cys Phe Leu Arg Arg		
465 470 475 480		
ctc gaa att ctg cgc aac gca cgc ctt tcc gat ggc gct gcc gct ctt		1488

Leu Glu Ile Leu Arg Asn Ala Arg Leu Ser Asp Gly Ala Ala Ala Leu  
 485 490 495

gtg gcc agc atc gat gac aca tac gtc ccg gcc gag aag ctg 1530  
 Val Ala Ser Ile Asp Asp Thr Tyr Val Pro Ala Glu Lys Leu  
 500 505 510

<210> 26  
 <211> 510  
 <212> PRT  
 <213> Schizochytrium sp.

<400> 26

Leu Leu Asp Leu Asp Ser Met Leu Ala Leu Ser Ser Ala Ser Ala Ser  
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Gly Asn Leu Val Glu Thr Ala Pro Ser Asp Ala Ser Val Ile Val Pro  
 20 25 30

Pro Cys Asn Ile Ala Asp Leu Gly Ser Arg Ala Phe Met Lys Thr Tyr  
 35 40 45

Gly Val Ser Ala Pro Leu Tyr Thr Gly Ala Met Ala Lys Gly Ile Ala  
 50 55 60

Ser Ala Asp Leu Val Ile Ala Ala Gly Arg Gln Gly Ile Leu Ala Ser  
 65 70 75 80

Phe Gly Ala Gly Gly Leu Pro Met Gln Val Val Arg Glu Ser Ile Glu  
 85 90 95

Lys Ile Gln Ala Ala Leu Pro Asn Gly Pro Tyr Ala Val Asn Leu Ile  
 100 105 110

His Ser Pro Phe Asp Ser Asn Leu Glu Lys Gly Asn Val Asp Leu Phe  
 115 120 125

Leu Glu Lys Gly Val Thr Phe Val Glu Ala Ser Ala Phe Met Thr Leu  
 130 135 140

Thr Pro Gln Val Val Arg Tyr Arg Ala Ala Gly Leu Thr Arg Asn Ala  
 145 150 155 160

Asp Gly Ser Val Asn Ile Arg Asn Arg Ile Ile Gly Lys Val Ser Arg  
 165 170 175

Thr Glu Leu Ala Glu Met Phe Met Arg Pro Ala Pro Glu His Leu Leu  
 180 185 190

Gln Lys Leu Ile Ala Ser Gly Glu Ile Asn Gln Glu Gln Ala Glu Leu  
 195 200 205

Ala Arg Arg Val Pro Val Ala Asp Asp Ile Ala Val Glu Ala Asp Ser

210                      215                      220  
 Gly Gly His Thr Asp Asn Arg Pro Ile His Val Ile Leu Pro Leu Ile  
 225                      230                      235                      240  
 Ile Asn Leu Arg Asp Arg Leu His Arg Glu Cys Gly Tyr Pro Ala Asn  
                     245                      250                      255  
 Leu Arg Val Arg Val Gly Ala Gly Gly Gly Ile Gly Cys Pro Gln Ala  
                     260                      265                      270  
 Ala Leu Ala Thr Phe Asn Met Gly Ala Ser Phe Ile Val Thr Gly Thr  
                     275                      280                      285  
 Val Asn Gln Val Ala Lys Gln Ser Gly Thr Cys Asp Asn Val Arg Lys  
                     290                      295                      300  
 Gln Leu Ala Lys Ala Thr Tyr Ser Asp Val Cys Met Ala Pro Ala Ala  
 305                      310                      315                      320  
 Asp Met Phe Glu Glu Gly Val Lys Leu Gln Val Leu Lys Lys Gly Thr  
                     325                      330                      335  
 Met Phe Pro Ser Arg Ala Asn Lys Leu Tyr Glu Leu Phe Cys Lys Tyr  
                     340                      345                      350  
 Asp Ser Phe Glu Ser Met Pro Pro Ala Glu Leu Ala Arg Val Glu Lys  
                     355                      360                      365  
 Arg Ile Phe Ser Arg Ala Leu Glu Glu Val Trp Asp Glu Thr Lys Asn  
                     370                      375                      380  
 Phe Tyr Ile Asn Arg Leu His Asn Pro Glu Lys Ile Gln Arg Ala Glu  
 385                      390                      395                      400  
 Arg Asp Pro Lys Leu Lys Met Ser Leu Cys Phe Arg Trp Tyr Leu Ser  
                     405                      410                      415  
 Leu Ala Ser Arg Trp Ala Asn Thr Gly Ala Ser Asp Arg Val Met Asp  
                     420                      425                      430  
 Tyr Gln Val Trp Cys Gly Pro Ala Ile Gly Ser Phe Asn Asp Phe Ile  
                     435                      440                      445  
 Lys Gly Thr Tyr Leu Asp Pro Ala Val Ala Asn Glu Tyr Pro Cys Val  
                     450                      455                      460  
 Val Gln Ile Asn Lys Gln Ile Leu Arg Gly Ala Cys Phe Leu Arg Arg  
 465                      470                      475                      480  
 Leu Glu Ile Leu Arg Asn Ala Arg Leu Ser Asp Gly Ala Ala Ala Leu

485

490

495

Val Ala Ser Ile Asp Asp Thr Tyr Val Pro Ala Glu Lys Leu  
 500 505 510

<210> 27  
 <211> 4512  
 <212> DNA  
 <213> Schizochytrium sp.

<220>  
 <221> CDS  
 <222> (1)..(4512)

<400> 27  
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 Met Ala Leu Arg Val Lys Thr Asn Lys Lys Pro Cys Trp Glu Met Thr  
 1 5 10 15  
 aag gag gag ctg acc agc ggc aag acc gag gtg ttc aac tat gag gaa 96  
 Lys Glu Glu Leu Thr Ser Gly Lys Thr Glu Val Phe Asn Tyr Glu Glu  
 20 25 30  
 ctc ctc gag ttc gca gag ggc gac atc gcc aag gtc ttc gga ccc gag 144  
 Leu Leu Glu Phe Ala Glu Gly Asp Ile Ala Lys Val Phe Gly Pro Glu  
 35 40 45  
 ttc gcc gtc atc gac aag tac ccg cgc cgc gtg cgc ctg ccc gcc cgc 192  
 Phe Ala Val Ile Asp Lys Tyr Pro Arg Arg Val Arg Leu Pro Ala Arg  
 50 55 60  
 gag tac ctg ctc gtg acc cgc gtc acc ctc atg gac gcc gag gtc aac 240  
 Glu Tyr Leu Leu Val Thr Arg Val Thr Leu Met Asp Ala Glu Val Asn  
 65 70 75 80  
 aac tac cgc gtc ggc gcc cgc atg gtc acc gag tac gat ctc ccc gtc 288  
 Asn Tyr Arg Val Gly Ala Arg Met Val Thr Glu Tyr Asp Leu Pro Val  
 85 90 95  
 aac gga gag ctc tcc gag ggc gga gac tgc ccc tgg gcc gtc ctg gtc 336  
 Asn Gly Glu Leu Ser Glu Gly Gly Asp Cys Pro Trp Ala Val Leu Val  
 100 105 110  
 gag agt ggc cag tgc gat ctc atg ctc atc tcc tac atg ggc att gac 384  
 Glu Ser Gly Gln Cys Asp Leu Met Leu Ile Ser Tyr Met Gly Ile Asp  
 115 120 125  
 ttc cag aac cag ggc gac cgc gtc tac cgc ctg ctc aac acc acg ctc 432  
 Phe Gln Asn Gln Gly Asp Arg Val Tyr Arg Leu Leu Asn Thr Thr Leu  
 130 135 140  
 acc ttt tac ggc gtg gcc cac gag ggc gag acc ctc gag tac gac att 480  
 Thr Phe Tyr Gly Val Ala His Glu Gly Glu Thr Leu Glu Tyr Asp Ile  
 145 150 155 160  
 cgc gtc acc ggc ttc gcc aag cgt ctc gac ggc ggc atc tcc atg ttc 528  
 Arg Val Thr Gly Phe Ala Lys Arg Leu Asp Gly Gly Ile Ser Met Phe  
 165 170 175  
 ttc ttc gag tac gac tgc tac gtc aac ggc cgc ctc ctc atc gag atg 576  
 Phe Phe Glu Tyr Asp Cys Tyr Val Asn Gly Arg Leu Leu Ile Glu Met  
 180 185 190  
 cgc gat ggc tgc gcc ggc ttc ttc acc aac gag gag ctc gac gcc ggc 624  
 Arg Asp Gly Cys Ala Gly Phe Phe Thr Asn Glu Glu Leu Asp Ala Gly

195										200										205										
aag ggc gtc gtc ttc acc cgc ggc gac ctc gcc gcc cgc gcc aag atc	672																													
Lys Gly Val Val Phe Thr Arg Gly Asp Leu Ala Arg Ala Lys Ile																														
210 215 220																														
cca aag cag gac gtc tcc ccc tac gcc gtc gcc ccc tgc ctc cac aag	720																													
Pro Lys Gln Asp Val Ser Pro Tyr Ala Val Ala Pro Cys Leu His Lys																														
225 230 235 240																														
acc aag ctc aac gaa aag gag atg cag acc ctc gtc gac aag gac tgg	768																													
Thr Lys Leu Asn Glu Lys Glu Met Gln Thr Leu Val Asp Lys Asp Trp																														
245 250 255																														
gca tcc gtc ttt ggc tcc aag aac ggc atg ccg gaa atc aac tac aaa	816																													
Ala Ser Val Phe Gly Ser Lys Asn Gly Met Pro Glu Ile Asn Tyr Lys																														
260 265 270																														
ctc tgc gcg cgt aag atg ctc atg att gac cgc gtc acc agc att gac	864																													
Leu Cys Ala Arg Lys Met Leu Met Ile Asp Arg Val Thr Ser Ile Asp																														
275 280 285																														
cac aag ggc ggt gtc tac ggc ctc ggt cag ctc gtc ggt gaa aag atc	912																													
His Lys Gly Gly Val Tyr Gly Leu Gly Gln Leu Val Gly Glu Lys Ile																														
290 295 300																														
ctc gag cgc gac cac tgg tac ttt ccc tgc cac ttt gtc aag gat cag	960																													
Leu Glu Arg Asp His Trp Tyr Phe Pro Cys His Phe Val Lys Asp Gln																														
305 310 315 320																														
gtc atg gcc gga tcc ctc gtc tcc gac ggc tgc agc cag atg ctc aag	1008																													
Val Met Ala Gly Ser Leu Val Ser Asp Gly Cys Ser Gln Met Leu Lys																														
325 330 335																														
atg tac atg atc tgg ctc ggc ctc cac ctc acc acc gga ccc ttt gac	1056																													
Met Tyr Met Ile Trp Leu Gly Leu His Leu Thr Thr Gly Pro Phe Asp																														
340 345 350																														
ttc cgc ccg gtc aac ggc cac ccc aac aag gtc cgc tgc cgc ggc caa	1104																													
Phe Arg Pro Val Asn Gly His Pro Asn Lys Val Arg Cys Arg Gly Gln																														
355 360 365																														
atc tcc ccg cac aag ggc aag ctc gtc tac gtc atg gag atc aag gag	1152																													
Ile Ser Pro His Lys Gly Lys Leu Val Tyr Val Met Glu Ile Lys Glu																														
370 375 380																														
atg ggc ttc gac gag gac aac gac ccg tac gcc att gcc gac gtc aac	1200																													
Met Gly Phe Asp Glu Asp Asn Asp Pro Tyr Ala Ile Ala Asp Val Asn																														
385 390 395 400																														
atc att gat gtc gac ttc gaa aag ggc cag gac ttt agc ctc gac cgc	1248																													
Ile Ile Asp Val Asp Phe Glu Lys Gly Gln Asp Phe Ser Leu Asp Arg																														
405 410 415																														
atc agc gac tac ggc aag ggc gac ctc aac aag aag atc gtc gtc gac	1296																													
Ile Ser Asp Tyr Gly Lys Gly Asp Leu Asn Lys Lys Ile Val Val Asp																														
420 425 430																														
ttt aag ggc atc gct ctc aag atg cag aag cgc tcc acc aac aag aac	1344																													
Phe Lys Gly Ile Ala Leu Lys Met Gln Lys Arg Ser Thr Asn Lys Asn																														
435 440 445																														
ccc tcc aag gtt cag ccc gtc ttt gcc aac ggc gcc gcc act gtc ggc	1392																													
Pro Ser Lys Val Gln Pro Phe Ala Asn Gly Ala Ala Thr Val Gly																														
450 455 460																														
ccc gag gcc tcc aag gct tcc tcc ggc gcc agc gcc agc gcc agc gcc	1440																													
Pro Glu Ala Ser Lys Ala Ser Ser Gly Ala Ser Ala Ser Ala Ser Ala																														

465	470	475	480	
gcc ccg gcc aag cct gcc ttc agc gcc gat gtt ctt gcg ccc aag ccc Ala Pro Ala Lys Pro Ala Phe Ser Ala Asp Val Leu Ala Pro Lys Pro	485	490	495	1488
gtt gcc ctt ccc gag cac atc ctc aag ggc gac gcc ctc gcc ccc aag Val Ala Leu Pro Glu His Ile Leu Lys Gly Asp Ala Leu Ala Pro Lys	500	505	510	1536
gag atg tcc tgg cac ccc atg gcc cgc atc ccg ggc aac ccg acg ccc Glu Met Ser Trp His Pro Met Ala Arg Ile Pro Gly Asn Pro Thr Pro	515	520	525	1584
tct ttt gcg ccc tcg gcc tac aag ccg cgc aac atc gcc ttt acg ccc Ser Phe Ala Pro Ser Ala Tyr Lys Pro Arg Asn Ile Ala Phe Thr Pro	530	535	540	1632
ttc ccc ggc aac ccc aac gat aac gac cac acc ccg ggc aag atg ccg Phe Pro Gly Asn Pro Asn Asp Asn Asp His Thr Pro Gly Lys Met Pro	545	550	555	1680
ctc acc tgg ttc aac atg gcc gag ttc atg gcc ggc aag gtc agc atg Leu Thr Trp Phe Asn Met Ala Glu Phe Met Ala Gly Lys Val Ser Met	565	570	575	1728
tgc ctc ggc ccc gag ttc gcc aag ttc gac gac tcg aac acc agc cgc Cys Leu Gly Pro Glu Phe Ala Lys Phe Asp Asp Ser Asn Thr Ser Arg	580	585	590	1776
agc ccc gct tgg gac ctc gct ctc gtc acc cgc gcc gtg tct gtg tct Ser Pro Ala Trp Asp Leu Ala Leu Val Thr Arg Ala Val Ser Val Ser	595	600	605	1824
gac ctc aag cac gtc aac tac cgc aac atc gac ctc gac ccc tcc aag Asp Leu Lys His Val Asn Tyr Arg Asn Ile Asp Leu Asp Pro Ser Lys	610	615	620	1872
ggc acc atg gtc ggc gag ttc gac tgc ccc ggc gac gcc tgg ttc tac Gly Thr Met Val Gly Glu Phe Asp Cys Pro Ala Asp Ala Trp Phe Tyr	625	630	635	1920
aag ggc gcc tgc aac gat gcc cac atg ccg tac tcg atc ctc atg gag Lys Gly Ala Cys Asn Asp Ala His Met Pro Tyr Ser Ile Leu Met Glu	645	650	655	1968
atc gcc ctc cag acc tcg ggt gtg ctc acc tcg gtg ctc aag gcg ccc Ile Ala Leu Gln Thr Ser Gly Val Leu Thr Ser Val Leu Lys Ala Pro	660	665	670	2016
ctg acc atg gag aag gac gac atc ctc ttc cgc aac ctc gac gcc aac Leu Thr Met Glu Lys Asp Asp Ile Leu Phe Arg Asn Leu Asp Ala Asn	675	680	685	2064
gcc gag ttc gtg cgc gcc gac ctc gac tac cgc ggc aag act atc cgc Ala Glu Phe Val Arg Ala Asp Leu Asp Tyr Arg Gly Lys Thr Ile Arg	690	695	700	2112
aac gtc acc aag tgc act ggc tac agc atg ctc ggc gag atg ggc gtc Asn Val Thr Lys Cys Thr Gly Tyr Ser Met Leu Gly Glu Met Gly Val	705	710	715	2160
cac cgc ttc acc ttt gag ctc tac gtc gat gat gtg ctc ttt tac aag His Arg Phe Thr Phe Glu Leu Tyr Val Asp Asp Val Leu Phe Tyr Lys	725	730	735	2208
ggc tcg acc tcg ttc ggc tgg ttc gtg ccc gag gtc ttt gcc gcc cag Gly Ser Thr Ser Phe Gly Trp Phe Val Pro Glu Val Phe Ala Ala Gln				2256

740	745	750	
gcc ggc ctc gac aac ggc cgc aag tgc gag ccc tgg ttc att gag aac Ala Gly Leu Asp Asn Gly Arg Lys Ser Glu Pro Trp Phe Ile Glu Asn 755 760 765			2304
aag gtt ccg gcc tgc cag gtc tcc tcc ttt gac gtg cgc ccc aac ggc Lys Val Pro Ala Ser Gln Val Ser Ser Phe Asp Val Arg Pro Asn Gly 770 775 780			2352
agc ggc cgc acc gcc atc ttc gcc aac gcc ccc agc ggc gcc cag ctc Ser Gly Arg Thr Ala Ile Phe Ala Asn Ala Pro Ser Gly Ala Gln Leu 785 790 795 800			2400
aac cgc cgc acg gac cag ggc cag tac ctc gac gcc gtc gac att gtc Asn Arg Arg Thr Asp Gln Gly Gln Tyr Leu Asp Ala Val Asp Ile Val 805 810 815			2448
tcc ggc agc ggc aag aag agc ctc ggc tac gcc cac ggt tcc aag acg Ser Gly Ser Gly Lys Lys Ser Leu Gly Tyr Ala His Gly Ser Lys Thr 820 825 830			2496
gtc aac ccg aac gac tgg ttc ttc tgc tgc cac ttt tgg ttt gac tgc Val Asn Pro Asn Asp Trp Phe Phe Ser Cys His Phe Trp Phe Asp Ser 835 840 845			2544
gtc atg ccc gga agt ctc ggt gtc gag tcc atg ttc cag ctc gtc gag Val Met Pro Gly Ser Leu Gly Val Glu Ser Met Phe Gln Leu Val Glu 850 855 860			2592
gcc atc gcc gcc cac gag gat ctc gct ggc aaa gca cgg cat tgc caa Ala Ile Ala Ala His Glu Asp Leu Ala Gly Lys Ala Arg His Cys Gln 865 870 875 880			2640
ccc cac ctt tgt gca cgc ccc cgg gca aga tca agc tgg aag tac cgc Pro His Leu Cys Ala Arg Pro Arg Ala Arg Ser Ser Trp Lys Tyr Arg 885 890 895			2688
ggc cag ctc acg ccc aag agc aag aag atg gac tgc gag gtc cac atc Gly Gln Leu Thr Pro Lys Ser Lys Lys Met Asp Ser Glu Val His Ile 900 905 910			2736
gtg tcc gtg gac gcc cac gac ggc gtt gtc gac ctc gtc gcc gac ggc Val Ser Val Asp Ala His Asp Gly Val Val Asp Leu Val Ala Asp Gly 915 920 925			2784
ttc ctc tgg gcc gac agc ctc cgc gtc tac tgc gtg agc aac att cgc Phe Leu Trp Ala Asp Ser Leu Arg Val Tyr Ser Val Ser Asn Ile Arg 930 935 940			2832
gtg cgc atc gcc tcc ggt gag gcc cct gcc gcc gcc tcc tcc gcc gcc Val Arg Ile Ala Ser Gly Glu Ala Pro Ala Ala Ala Ser Ser Ala Ala 945 950 955 960			2880
tct gtg ggc tcc tgc gct tgc tcc gtc gag cgc acg cgc tgc agc ccc Ser Val Gly Ser Ser Ala Ser Ser Val Glu Arg Thr Arg Ser Ser Pro 965 970 975			2928
gct gtc gcc tcc ggc ccg gcc cag acc atc gac ctc aag cag ctc aag Ala Val Ala Ser Gly Pro Ala Gln Thr Ile Asp Leu Lys Gln Leu Lys 980 985 990			2976
acc gag ctc ctc gag ctc gat gcc ccg ctc tac ctc tgc cag gac ccg Thr Glu Leu Leu Glu Leu Asp Ala Pro Leu Tyr Leu Ser Gln Asp Pro 995 1000 1005			3024
acc agc ggc cag ctc aag aag cac acc gac gtg gcc tcc ggc cag Thr Ser Gly Gln Leu Lys Lys His Thr Asp Val Ala Ser Gly Gln			3069



1010	1015	1020	
gcc acc atc gtg cag ccc tgc acg ctc ggc gac ctc ggt gac cgc Ala Thr Ile Val Gln Pro Cys Thr Leu Gly Asp Leu Gly Asp Arg 1025 1030 1035			3114
tcc ttc atg gag acc tac ggc gtc gtc gcc ccg ctg tac acg ggc Ser Phe Met Glu Thr Tyr Gly Val Val Ala Pro Leu Tyr Thr Gly 1040 1045 1050			3159
gcc atg gcc aag ggc att gcc tcg gcg gac ctc gtc atc gcc gcc Ala Met Ala Lys Gly Ile Ala Ser Ala Asp Leu Val Ile Ala Ala 1055 1060 1065			3204
ggc aag cgc aag atc ctc ggc tcc ttt ggc gcc ggc ggc ctc ccc Gly Lys Arg Lys Ile Leu Gly Ser Phe Gly Ala Gly Gly Leu Pro 1070 1075 1080			3249
atg cac cac gtg cgc gcc gcc ctc gag aag atc cag gcc gcc ctg Met His His Val Arg Ala Ala Leu Glu Lys Ile Gln Ala Ala Leu 1085 1090 1095			3294
cct cag ggc ccc tac gcc gtc aac ctc atc cac tcg cct ttt gac Pro Gln Gly Pro Tyr Ala Val Asn Leu Ile His Ser Pro Phe Asp 1100 1105 1110			3339
agc aac ctc gag aag ggc aac gtc gat ctc ttc ctc gag aag ggc Ser Asn Leu Glu Lys Gly Asn Val Asp Leu Phe Leu Glu Lys Gly 1115 1120 1125			3384
gtc act gtg gtg gag gcc tcg gca ttc atg acc ctc acc ccg cag Val Thr Val Val Glu Ala Ser Ala Phe Met Thr Leu Thr Pro Gln 1130 1135 1140			3429
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tcg gtc aac atc cgc aac cgc atc atc ggc aag gtc tcg cgc acc Ser Val Asn Ile Arg Asn Arg Ile Ile Gly Lys Val Ser Arg Thr 1160 1165 1170			3519
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ccg ctc atc atc aac ctc cgc aac cgc ctg cac cgc gag tgc ggc Pro Leu Ile Ile Asn Leu Arg Asn Arg Leu His Arg Glu Cys Gly 1235 1240 1245			3744
tac ccc gcg cac ctc cgc gtc cgc gtt ggc gcc ggc ggt ggc gtc Tyr Pro Ala His Leu Arg Val Arg Val Gly Ala Gly Gly Gly Val 1250 1255 1260			3789
ggc tgc ccg cag gcc gcc gcc gcc gcg ctc acc atg ggc gcc gcc Gly Cys Pro Gln Ala Ala Ala Ala Ala Leu Thr Met Gly Ala Ala 1265 1270 1275			3834

1265	1270	1275	
ttc atc gtc acc ggc act Phe Ile Val Thr Gly Thr 1280	gtc aac cag gtc gcc Val Asn Gln Val Ala 1285	aag cag tcc ggc Lys Gln Ser Gly 1290	3879
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gat atc tgc atg gcc ccg Asp Ile Cys Met Ala Pro 1310	gcc gac atg ttc Ala Asp Met Phe 1315	gag gag ggc gtc Glu Glu Gly Val 1320	3969
aag ctc cag gtc ctc aag Lys Leu Gln Val Leu Lys 1325	aag gga acc atg ttc Lys Gly Thr Met Phe 1330	ccc tgc cgc gcc Pro Ser Arg Ala 1335	4014
aac aag ctc tac gag ctc Asn Lys Leu Tyr Glu Leu 1340	ttt tgc aag tac gac Phe Cys Lys Tyr Asp 1345	tcc ttc gac tcc Ser Phe Asp Ser 1350	4059
atg cct cct gcc gag ctc Met Pro Pro Ala Glu Leu 1355	gag cgc atc gag aag Glu Arg Ile Glu Lys 1360	cgt atc ttc aag Arg Ile Phe Lys 1365	4104
cgc gca ctc cag gag gtc Arg Ala Leu Gln Glu Val 1370	tgg gag gag acc aag Trp Glu Glu Thr Lys 1375	gac ttt tac att Asp Phe Tyr Ile 1380	4149
aac ggt ctc aag aac ccg Asn Gly Leu Lys Asn Pro 1385	gag aag atc cag cgc Glu Lys Ile Gln Arg 1390	gcc gag cac gac Ala Glu His Asp 1395	4194
ccc aag ctc aag atg tgc Pro Lys Leu Lys Met Ser 1400	ctc tgc ttc cgc tgg Leu Cys Phe Arg Trp 1405	tac ctt ggt ctt Tyr Leu Gly Leu 1410	4239
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tac cag gtc tgg tgt ggc Tyr Gln Val Trp Cys Gly 1430	ccg gcc att ggc gcc Pro Ala Ile Gly Ala 1435	ttc aac gac ttc Phe Asn Asp Phe 1440	4329
atc aag ggc acc tac ctc Ile Lys Gly Thr Tyr Leu 1445	gac ccc gct gtc tcc Asp Pro Ala Val Ser 1450	aac gag tac ccc Asn Glu Tyr Pro 1455	4374
tgt gtc gtc cag atc aac Cys Val Val Gln Ile Asn 1460	ctg caa atc ctc cgt Leu Gln Ile Leu Arg 1465	ggt gcc tgc tac Gly Ala Cys Tyr 1470	4419
ctg cgc cgt ctc aac gcc Leu Arg Arg Leu Asn Ala 1475	ctg cgc aac gac ccg Leu Arg Asn Asp Pro 1480	cgc att gac ctc Arg Ile Asp Leu 1485	4464
gag acc gag gat gct gcc Glu Thr Glu Asp Ala Ala 1490	ttt gtc tac gag ccc Phe Val Tyr Glu Pro 1495	acc aac gcg ctc Thr Asn Ala Leu 1500	4509
taa			4512

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35 40 45

Phe Ala Val Ile Asp Lys Tyr Pro Arg Arg Val Arg Leu Pro Ala Arg  
50 55 60

Glu Tyr Leu Leu Val Thr Arg Val Thr Leu Met Asp Ala Glu Val Asn  
65 70 75 80

Asn Tyr Arg Val Gly Ala Arg Met Val Thr Glu Tyr Asp Leu Pro Val  
85 90 95

Asn Gly Glu Leu Ser Glu Gly Gly Asp Cys Pro Trp Ala Val Leu Val  
100 105 110

Glu Ser Gly Gln Cys Asp Leu Met Leu Ile Ser Tyr Met Gly Ile Asp  
115 120 125

Phe Gln Asn Gln Gly Asp Arg Val Tyr Arg Leu Leu Asn Thr Thr Leu  
130 135 140

Thr Phe Tyr Gly Val Ala His Glu Gly Glu Thr Leu Glu Tyr Asp Ile  
145 150 155 160

Arg Val Thr Gly Phe Ala Lys Arg Leu Asp Gly Gly Ile Ser Met Phe  
165 170 175

Phe Phe Glu Tyr Asp Cys Tyr Val Asn Gly Arg Leu Leu Ile Glu Met  
180 185 190

Arg Asp Gly Cys Ala Gly Phe Phe Thr Asn Glu Glu Leu Asp Ala Gly  
195 200 205

Lys Gly Val Val Phe Thr Arg Gly Asp Leu Ala Ala Arg Ala Lys Ile  
210 215 220

Pro Lys Gln Asp Val Ser Pro Tyr Ala Val Ala Pro Cys Leu His Lys  
225 230 235 240

Thr Lys Leu Asn Glu Lys Glu Met Gln Thr Leu Val Asp Lys Asp Trp  
245 250 255

Ala Ser Val Phe Gly Ser Lys Asn Gly Met Pro Glu Ile Asn Tyr Lys  
 260 265 270

Leu Cys Ala Arg Lys Met Leu Met Ile Asp Arg Val Thr Ser Ile Asp  
 275 280 285

His Lys Gly Gly Val Tyr Gly Leu Gly Gln Leu Val Gly Glu Lys Ile  
 290 295 300

Leu Glu Arg Asp His Trp Tyr Phe Pro Cys His Phe Val Lys Asp Gln  
 305 310 315 320

Val Met Ala Gly Ser Leu Val Ser Asp Gly Cys Ser Gln Met Leu Lys  
 325 330 335

Met Tyr Met Ile Trp Leu Gly Leu His Leu Thr Thr Gly Pro Phe Asp  
 340 345 350

Phe Arg Pro Val Asn Gly His Pro Asn Lys Val Arg Cys Arg Gly Gln  
 355 360 365

Ile Ser Pro His Lys Gly Lys Leu Val Tyr Val Met Glu Ile Lys Glu  
 370 375 380

Met Gly Phe Asp Glu Asp Asn Asp Pro Tyr Ala Ile Ala Asp Val Asn  
 385 390 395 400

Ile Ile Asp Val Asp Phe Glu Lys Gly Gln Asp Phe Ser Leu Asp Arg  
 405 410 415

Ile Ser Asp Tyr Gly Lys Gly Asp Leu Asn Lys Lys Ile Val Val Asp  
 420 425 430

Phe Lys Gly Ile Ala Leu Lys Met Gln Lys Arg Ser Thr Asn Lys Asn  
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Pro Ser Lys Val Gln Pro Val Phe Ala Asn Gly Ala Ala Thr Val Gly  
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Pro Glu Ala Ser Lys Ala Ser Ser Gly Ala Ser Ala Ser Ala Ser Ala  
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Ala Pro Ala Lys Pro Ala Phe Ser Ala Asp Val Leu Ala Pro Lys Pro  
 485 490 495

Val Ala Leu Pro Glu His Ile Leu Lys Gly Asp Ala Leu Ala Pro Lys  
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Glu Met Ser Trp His Pro Met Ala Arg Ile Pro Gly Asn Pro Thr Pro  
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Ser Phe Ala Pro Ser Ala Tyr Lys Pro Arg Asn Ile Ala Phe Thr Pro  
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Phe Pro Gly Asn Pro Asn Asp Asn Asp His Thr Pro Gly Lys Met Pro  
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Leu Thr Trp Phe Asn Met Ala Glu Phe Met Ala Gly Lys Val Ser Met  
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Cys Leu Gly Pro Glu Phe Ala Lys Phe Asp Asp Ser Asn Thr Ser Arg  
 580 585 590

Ser Pro Ala Trp Asp Leu Ala Leu Val Thr Arg Ala Val Ser Val Ser  
 595 600 605

Asp Leu Lys His Val Asn Tyr Arg Asn Ile Asp Leu Asp Pro Ser Lys  
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Gly Thr Met Val Gly Glu Phe Asp Cys Pro Ala Asp Ala Trp Phe Tyr  
 625 630 635 640

Lys Gly Ala Cys Asn Asp Ala His Met Pro Tyr Ser Ile Leu Met Glu  
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Ile Ala Leu Gln Thr Ser Gly Val Leu Thr Ser Val Leu Lys Ala Pro  
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Leu Thr Met Glu Lys Asp Asp Ile Leu Phe Arg Asn Leu Asp Ala Asn  
 675 680 685

Ala Glu Phe Val Arg Ala Asp Leu Asp Tyr Arg Gly Lys Thr Ile Arg  
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Asn Val Thr Lys Cys Thr Gly Tyr Ser Met Leu Gly Glu Met Gly Val  
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His Arg Phe Thr Phe Glu Leu Tyr Val Asp Asp Val Leu Phe Tyr Lys  
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Gly Ser Thr Ser Phe Gly Trp Phe Val Pro Glu Val Phe Ala Ala Gln  
 740 745 750

Ala Gly Leu Asp Asn Gly Arg Lys Ser Glu Pro Trp Phe Ile Glu Asn  
 755 760 765

Lys Val Pro Ala Ser Gln Val Ser Ser Phe Asp Val Arg Pro Asn Gly  
 770 775 780

Ser Gly Arg Thr Ala Ile Phe Ala Asn Ala Pro Ser Gly Ala Gln Leu  
 785 790 795 800

Asn Arg Arg Thr Asp Gln Gly Gln Tyr Leu Asp Ala Val Asp Ile Val  
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 Ser Gly Ser Gly Lys Lys Ser Leu Gly Tyr Ala His Gly Ser Lys Thr  
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 Val Asn Pro Asn Asp Trp Phe Phe Ser Cys His Phe Trp Phe Asp Ser  
 835 840 845  
 Val Met Pro Gly Ser Leu Gly Val Glu Ser Met Phe Gln Leu Val Glu  
 850 855 860  
 Ala Ile Ala Ala His Glu Asp Leu Ala Gly Lys Ala Arg His Cys Gln  
 865 870 875 880  
 Pro His Leu Cys Ala Arg Pro Arg Ala Arg Ser Ser Trp Lys Tyr Arg  
 885 890 895  
 Gly Gln Leu Thr Pro Lys Ser Lys Lys Met Asp Ser Glu Val His Ile  
 900 905 910  
 Val Ser Val Asp Ala His Asp Gly Val Val Asp Leu Val Ala Asp Gly  
 915 920 925  
 Phe Leu Trp Ala Asp Ser Leu Arg Val Tyr Ser Val Ser Asn Ile Arg  
 930 935 940  
 Val Arg Ile Ala Ser Gly Glu Ala Pro Ala Ala Ala Ser Ser Ala Ala  
 945 950 955 960  
 Ser Val Gly Ser Ser Ala Ser Ser Val Glu Arg Thr Arg Ser Ser Pro  
 965 970 975  
 Ala Val Ala Ser Gly Pro Ala Gln Thr Ile Asp Leu Lys Gln Leu Lys  
 980 985 990  
 Thr Glu Leu Leu Glu Leu Asp Ala Pro Leu Tyr Leu Ser Gln Asp Pro  
 995 1000 1005  
 Thr Ser Gly Gln Leu Lys Lys His Thr Asp Val Ala Ser Gly Gln  
 1010 1015 1020  
 Ala Thr Ile Val Gln Pro Cys Thr Leu Gly Asp Leu Gly Asp Arg  
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 Ser Phe Met Glu Thr Tyr Gly Val Val Ala Pro Leu Tyr Thr Gly  
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 Ala Met Ala Lys Gly Ile Ala Ser Ala Asp Leu Val Ile Ala Ala  
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Gly	Lys	Arg	Lys	Ile	Leu	Gly	Ser	Phe	Gly	Ala	Gly	Gly	Leu	Pro
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Met	His	His	Val	Arg	Ala	Ala	Leu	Glu	Lys	Ile	Gln	Ala	Ala	Leu
1085						1090					1095			
Pro	Gln	Gly	Pro	Tyr	Ala	Val	Asn	Leu	Ile	His	Ser	Pro	Phe	Asp
1100						1105					1110			
Ser	Asn	Leu	Glu	Lys	Gly	Asn	Val	Asp	Leu	Phe	Leu	Glu	Lys	Gly
1115						1120					1125			
Val	Thr	Val	Val	Glu	Ala	Ser	Ala	Phe	Met	Thr	Leu	Thr	Pro	Gln
1130						1135					1140			
Val	Val	Arg	Tyr	Arg	Ala	Ala	Gly	Leu	Ser	Arg	Asn	Ala	Asp	Gly
1145						1150					1155			
Ser	Val	Asn	Ile	Arg	Asn	Arg	Ile	Ile	Gly	Lys	Val	Ser	Arg	Thr
1160						1165					1170			
Glu	Leu	Ala	Glu	Met	Phe	Ile	Arg	Pro	Ala	Pro	Glu	His	Leu	Leu
1175						1180					1185			
Glu	Lys	Leu	Ile	Ala	Ser	Gly	Glu	Ile	Thr	Gln	Glu	Gln	Ala	Glu
1190						1195					1200			
Leu	Ala	Arg	Arg	Val	Pro	Val	Ala	Asp	Asp	Ile	Ala	Val	Glu	Ala
1205						1210					1215			
Asp	Ser	Gly	Gly	His	Thr	Asp	Asn	Arg	Pro	Ile	His	Val	Ile	Leu
1220						1225					1230			
Pro	Leu	Ile	Ile	Asn	Leu	Arg	Asn	Arg	Leu	His	Arg	Glu	Cys	Gly
1235						1240					1245			
Tyr	Pro	Ala	His	Leu	Arg	Val	Arg	Val	Gly	Ala	Gly	Gly	Gly	Val
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Gly	Cys	Pro	Gln	Ala	Ala	Ala	Ala	Ala	Leu	Thr	Met	Gly	Ala	Ala
1265						1270					1275			
Phe	Ile	Val	Thr	Gly	Thr	Val	Asn	Gln	Val	Ala	Lys	Gln	Ser	Gly
1280						1285					1290			
Thr	Cys	Asp	Asn	Val	Arg	Lys	Gln	Leu	Ser	Gln	Ala	Thr	Tyr	Ser
1295						1300					1305			
Asp	Ile	Cys	Met	Ala	Pro	Ala	Ala	Asp	Met	Phe	Glu	Glu	Gly	Val
1310						1315					1320			

Lys Leu Gln Val Leu Lys Lys Gly Thr Met Phe Pro Ser Arg Ala  
1325 1330 1335

Asn Lys Leu Tyr Glu Leu Phe Cys Lys Tyr Asp Ser Phe Asp Ser  
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Met Pro Pro Ala Glu Leu Glu Arg Ile Glu Lys Arg Ile Phe Lys  
1355 1360 1365

Arg Ala Leu Gln Glu Val Trp Glu Glu Thr Lys Asp Phe Tyr Ile  
1370 1375 1380

Asn Gly Leu Lys Asn Pro Glu Lys Ile Gln Arg Ala Glu His Asp  
1385 1390 1395

Pro Lys Leu Lys Met Ser Leu Cys Phe Arg Trp Tyr Leu Gly Leu  
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Ala Ser Arg Trp Ala Asn Met Gly Ala Pro Asp Arg Val Met Asp  
1415 1420 1425

Tyr Gln Val Trp Cys Gly Pro Ala Ile Gly Ala Phe Asn Asp Phe  
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Ile Lys Gly Thr Tyr Leu Asp Pro Ala Val Ser Asn Glu Tyr Pro  
1445 1450 1455

Cys Val Val Gln Ile Asn Leu Gln Ile Leu Arg Gly Ala Cys Tyr  
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gcc tcc aag gct tcc tcc ggc gcc agc gcc agc gcc agc gcc gcc ccg 96  
Ala Ser Lys Ala Ser Ser Gly Ala Ser Ala Ser Ala Ser Ala Ala Pro  
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gcc aag cct gcc ttc agc gcc gat gtt ctt gcg ccc aag ccc gtt gcc 144



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Leu	Pro	Glu	His	Ile	Leu	Lys	Gly	Asp	Ala	Leu	Ala	Pro	Lys	Glu	Met		
	50					55					60						
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Ser	Trp	His	Pro	Met	Ala	Arg	Ile	Pro	Gly	Asn	Pro	Thr	Pro	Ser	Phe		
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gcg	ccc	tcg	gcc	tac	aag	ccg	cgc	aac	atc	gcc	ttt	acg	ccc	ttc	ccc	288	
Ala	Pro	Ser	Ala	Tyr	Lys	Pro	Arg	Asn	Ile	Ala	Phe	Thr	Pro	Phe	Pro		
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Trp	Phe	Asn	Met	Ala	Glu	Phe	Met	Ala	Gly	Lys	Val	Ser	Met	Cys	Leu		
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Gly	Pro	Glu	Phe	Ala	Lys	Phe	Asp	Asp	Ser	Asn	Thr	Ser	Arg	Ser	Pro		
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Ala	Trp	Asp	Leu	Ala	Leu	Val	Thr	Arg	Ala	Val	Ser	Val	Ser	Asp	Leu		
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Lys	His	Val	Asn	Tyr	Arg	Asn	Ile	Asp	Leu	Asp	Pro	Ser	Lys	Gly	Thr		
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Met	Val	Gly	Glu	Phe	Asp	Cys	Pro	Ala	Asp	Ala	Trp	Phe	Tyr	Lys	Gly		
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gcc	tgc	aac	gat	gcc	cac	atg	ccg	tac	tcg	atc	ctc	atg	gag	atc	gcc	624	
Ala	Cys	Asn	Asp	Ala	His	Met	Pro	Tyr	Ser	Ile	Leu	Met	Glu	Ile	Ala		
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ctc	cag	acc	tcg	ggc	gtg	ctc	acc	tcg	gtg	ctc	aag	gcg	ccc	ctg	acc	672	
Leu	Gln	Thr	Ser	Gly	Val	Leu	Thr	Ser	Val	Leu	Lys	Ala	Pro	Leu	Thr		
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Phe	Val	Arg	Ala	Asp	Leu	Asp	Tyr	Arg	Gly	Lys	Thr	Ile	Arg	Asn	Val		
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Thr	Lys	Cys	Thr	Gly	Tyr	Ser	Met	Leu	Gly	Glu	Met	Gly	Val	His	Arg		
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Phe	Thr	Phe	Glu	Leu	Tyr	Val	Asp	Asp	Val	Leu	Phe	Tyr	Lys	Gly	Ser		
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Thr	Ser	Phe	Gly	Trp	Phe	Val	Pro	Glu	Val	Phe	Ala	Ala	Gln	Ala	Gly		
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ctc	gac	aac	ggc	cgc	aag	tcg	gag	ccc	tgg	ttc	att	gag	aac	aag	gtt	960	

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305					310					315					320		
ccg	gcc	tcg	cag	gtc	tcc	tcc	ttt	gac	gtg	cgc	ccc	aac	ggc	agc	ggc	1008	
Pro	Ala	Ser	Gln	Val	Ser	Ser	Phe	Asp	Val	Arg	Pro	Asn	Gly	Ser	Gly		
			325					330					335				
cgc	acc	gcc	atc	ttc	gcc	aac	gcc	ccc	agc	ggc	gcc	cag	ctc	aac	cgc	1056	
Arg	Thr	Ala	Ile	Phe	Ala	Asn	Ala	Pro	Ser	Gly	Ala	Gln	Leu	Asn	Arg		
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cgc	acg	gac	cag	ggc	cag	tac	ctc	gac	gcc	gtc	gac	att	gtc	tcc	ggc	1104	
Arg	Thr	Asp	Gln	Gly	Gln	Tyr	Leu	Asp	Ala	Val	Asp	Ile	Val	Ser	Gly		
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agc	ggc	aag	aag	agc	ctc	ggc	tac	gcc	cac	ggc	tcc	aag	acg	gtc	aac	1152	
Ser	Gly	Lys	Lys	Ser	Leu	Tyr	Ala	His	Gly	Ser	Lys	Thr	Val	Asn			
	370					375					380						
ccg	aac	gac	tgg	ttc	ttc	tcg	tgc	cac	ttt	tgg	ttt	gac	tcg	gtc	atg	1200	
Pro	Asn	Asp	Trp	Phe	Phe	Ser	Cys	His	Phe	Trp	Phe	Asp	Ser	Val	Met		
385					390					395				400			
ccc	gga	agt	ctc	ggc	gtc	gag	tcc	atg	ttc	cag	ctc	gtc	gag	gcc	atc	1248	
Pro	Gly	Ser	Leu	Gly	Val	Glu	Ser	Met	Phe	Gln	Leu	Val	Glu	Ala	Ile		
			405					410					415				
gcc	gcc	cac	gag	gat	ctc	gct	ggc	aaa	gca	cgg	cat	tgc	caa	ccc	cac	1296	
Ala	Ala	His	Glu	Asp	Leu	Ala	Gly	Lys	Ala	Arg	His	Cys	Gln	Pro	His		
			420				425					430					
ctt	tgt	gca	cgc	ccc	cgg	gca	aga	tca	agc	tgg	aag	tac	cgc	ggc	cag	1344	
Leu	Cys	Ala	Arg	Pro	Arg	Ala	Arg	Ser	Ser	Trp	Lys	Tyr	Arg	Gly	Gln		
		435					440					445					
ctc	acg	ccc	aag	agc	aag	aag	atg	gac	tcg	gag	gtc	cac	atc	gtg	tcc	1392	
Leu	Thr	Pro	Lys	Ser	Lys	Lys	Met	Asp	Ser	Glu	Val	His	Ile	Val	Ser		
	450					455					460						
gtg	gac	gcc	cac	gac	ggc	gtt	gtc	gac	ctc	gtc	gcc	gac	ggc	ttc	ctc	1440	
Val	Asp	Ala	His	Asp	Gly	Val	Val	Asp	Leu	Val	Ala	Asp	Gly	Phe	Leu		
465					470					475				480			
tgg	gcc	gac	agc	ctc	cgc	gtc	tac	tcg	gtg	agc	aac	att	cgc	gtg	cgc	1488	
Trp	Ala	Asp	Ser	Leu	Arg	Val	Tyr	Ser	Val	Ser	Asn	Ile	Arg	Val	Arg		
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atc	gcc	tcc	ggc													1500	
Ile	Ala	Ser	Gly														
			500														

<210> 30  
 <211> 500  
 <212> PRT  
 <213> Schizochytrium sp.

<400> 30

Lys	Val	Gln	Pro	Val	Phe	Ala	Asn	Gly	Ala	Ala	Thr	Val	Gly	Pro	Glu
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Ala	Ser	Lys	Ala	Ser	Ser	Gly	Ala	Ser	Ala	Ser	Ala	Ser	Ala	Ala	Pro
			20					25					30		

Ala	Lys	Pro	Ala	Phe	Ser	Ala	Asp	Val	Leu	Ala	Pro	Lys	Pro	Val	Ala
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----



305                      310                      315                      320  
 Pro Ala Ser Gln Val Ser Ser Phe Asp Val Arg Pro Asn Gly Ser Gly  
                          325                      330                      335  
 Arg Thr Ala Ile Phe Ala Asn Ala Pro Ser Gly Ala Gln Leu Asn Arg  
                          340                      345                      350  
 Arg Thr Asp Gln Gly Gln Tyr Leu Asp Ala Val Asp Ile Val Ser Gly  
                          355                      360                      365  
 Ser Gly Lys Lys Ser Leu Gly Tyr Ala His Gly Ser Lys Thr Val Asn  
                          370                      375                      380  
 Pro Asn Asp Trp Phe Phe Ser Cys His Phe Trp Phe Asp Ser Val Met  
                          385                      390                      395                      400  
 Pro Gly Ser Leu Gly Val Glu Ser Met Phe Gln Leu Val Glu Ala Ile  
                          405                      410                      415  
 Ala Ala His Glu Asp Leu Ala Gly Lys Ala Arg His Cys Gln Pro His  
                          420                      425                      430  
 Leu Cys Ala Arg Pro Arg Ala Arg Ser Ser Trp Lys Tyr Arg Gly Gln  
                          435                      440                      445  
 Leu Thr Pro Lys Ser Lys Lys Met Asp Ser Glu Val His Ile Val Ser  
                          450                      455                      460  
 Val Asp Ala His Asp Gly Val Val Asp Leu Val Ala Asp Gly Phe Leu  
                          465                      470                      475                      480  
 Trp Ala Asp Ser Leu Arg Val Tyr Ser Val Ser Asn Ile Arg Val Arg  
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 Ile Ala Ser Gly  
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<210> 31  
 <211> 1512  
 <212> DNA  
 <213> Schizochytrium sp.

<220>  
 <221> CDS  
 <222> (1)..(1512)

<400> 31  
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 Ala Pro Leu Tyr Leu Ser Gln Asp Pro Thr Ser Gly Gln Leu Lys Lys  
 1                      5                      10                      15  
 cac acc gac gtg gcc tcc ggc cag gcc acc atc gtg cag ccc tgc acg                      96  
 His Thr Asp Val Ala Ser Gly Gln Ala Thr Ile Val Gln Pro Cys Thr

20										25										30										
ctc	ggc	gac	ctc	ggc	gac	cgc	tcc	ttc	atg	gag	acc	tac	ggc	gtc	gtc	144														
Leu	Gly	Asp	Leu	Gly	Asp	Arg	Ser	Phe	Met	Glu	Thr	Tyr	Gly	Val	Val															
	35						40					45																		
gcc	ccg	ctg	tac	acg	ggc	gcc	atg	gcc	aag	ggc	att	gcc	tcg	gcg	gac	192														
Ala	Pro	Leu	Tyr	Thr	Gly	Ala	Met	Ala	Lys	Gly	Ile	Ala	Ser	Ala	Asp															
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ctc	gtc	atc	gcc	gcc	ggc	aag	cgc	aag	atc	ctc	ggc	tcc	ttt	ggc	gcc	240														
Leu	Val	Ile	Ala	Ala	Gly	Lys	Arg	Lys	Ile	Leu	Gly	Ser	Phe	Gly	Ala															
65				70					75						80															
ggc	ggc	ctc	ccc	atg	cac	cac	gtg	cgc	gcc	gcc	ctc	gag	aag	atc	cag	288														
Gly	Gly	Leu	Pro	Met	His	His	Val	Arg	Ala	Ala	Leu	Glu	Lys	Ile	Gln															
				85					90					95																
gcc	gcc	ctg	cct	cag	ggc	ccc	tac	gcc	gtc	aac	ctc	atc	cac	tcg	cct	336														
Ala	Ala	Leu	Pro	Gln	Gly	Pro	Tyr	Ala	Val	Asn	Leu	Ile	His	Ser	Pro															
			100					105						110																
ttt	gac	agc	aac	ctc	gag	aag	ggc	aac	gtc	gat	ctc	ttc	ctc	gag	aag	384														
Phe	Asp	Ser	Asn	Leu	Glu	Lys	Gly	Asn	Val	Asp	Leu	Phe	Leu	Glu	Lys															
	115						120					125																		
ggc	gtc	act	gtg	gtg	gag	gcc	tcg	gca	ttc	atg	acc	ctc	acc	ccg	cag	432														
Gly	Val	Thr	Val	Val	Glu	Ala	Ser	Ala	Phe	Met	Thr	Leu	Thr	Pro	Gln															
	130					135					140																			
gtc	gtg	cgc	tac	cgc	gcc	gcc	ggc	ctc	tcg	cgc	aac	gcc	gac	ggc	tcg	480														
Val	Val	Arg	Tyr	Arg	Ala	Ala	Gly	Leu	Ser	Arg	Asn	Ala	Asp	Gly	Ser															
145					150					155					160															
gtc	aac	atc	cgc	aac	cgc	atc	atc	ggc	aag	gtc	tcg	cgc	acc	gag	ctc	528														
Val	Asn	Ile	Arg	Asn	Arg	Ile	Ile	Gly	Lys	Val	Ser	Arg	Thr	Glu	Leu															
				165					170					175																
gcc	gag	atg	ttc	atc	cgc	ccg	gcc	ccg	gag	cac	ctc	ctc	gag	aag	ctc	576														
Ala	Glu	Met	Phe	Ile	Arg	Pro	Ala	Pro	Glu	His	Leu	Leu	Glu	Lys	Leu															
			180					185						190																
atc	gcc	tcg	ggc	gag	atc	acc	cag	gag	cag	gcc	gag	ctc	gcg	cgc	cgc	624														
Ile	Ala	Ser	Gly	Glu	Ile	Thr	Gln	Glu	Gln	Ala	Glu	Leu	Ala	Arg	Arg															
	195						200					205																		
gtt	ccc	gtc	gcc	gac	gat	atc	gct	gtc	gag	gct	gac	tcg	ggc	ggc	cac	672														
Val	Pro	Val	Ala	Asp	Asp	Ile	Ala	Val	Glu	Ala	Asp	Ser	Gly	Gly	His															
	210					215					220																			
acc	gac	aac	cgc	ccc	atc	cac	gtc	atc	ctc	ccg	ctc	atc	atc	aac	ctc	720														
Thr	Asp	Asn	Arg	Pro	Ile	His	Val	Ile	Leu	Pro	Leu	Ile	Ile	Asn	Leu															
225					230					235					240															
cgc	aac	cgc	ctg	cac	cgc	gag	tgc	ggc	tac	ccc	gcg	cac	ctc	cgc	gtc	768														
Arg	Asn	Arg	Leu	His	Arg	Glu	Cys	Gly	Tyr	Pro	Ala	His	Leu	Arg	Val															
				245					250					255																
cgc	gtt	ggc	gcc	ggc	ggc	ggc	gtc	ggc	tgc	ccg	cag	gcc	gcc	gcc	gcc	816														
Arg	Val	Gly	Ala	Gly	Gly	Gly	Val	Gly	Cys	Pro	Gln	Ala	Ala	Ala	Ala															
			260					265					270																	
gcg	ctc	acc	atg	ggc	gcc	gcc	ttc	atc	gtc	acc	ggc	act	gtc	aac	cag	864														
Ala	Leu	Thr	Met	Gly	Ala	Ala	Phe	Ile	Val	Thr	Gly	Thr	Val	Asn	Gln															
		275					280					285																		
gtc	gcc	aag	cag	tcc	ggc	acc	tgc	gac	aac	gtg	cgc	aag	cag	ctc	tcg	912														
Val	Ala	Lys	Gln	Ser	Gly	Thr	Cys	Asp	Asn	Val	Arg	Lys	Gln	Leu	Ser															

290	295	300	
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gag gag ggc gtc aag ctc cag gtc ctc aag aag gga acc atg ttc ccc Glu Glu Gly Val Lys Leu Gln Val Leu Lys Lys Gly Thr Met Phe Pro 325 330 335			1008
tcg cgc gcc aac aag ctc tac gag ctc ttt tgc aag tac gac tcc ttc Ser Arg Ala Asn Lys Leu Tyr Glu Leu Phe Cys Lys Tyr Asp Ser Phe 340 345 350			1056
gac tcc atg cct cct gcc gag ctc gag cgc atc gag aag cgt atc ttc Asp Ser Met Pro Pro Ala Glu Leu Glu Arg Ile Glu Lys Arg Ile Phe 355 360 365			1104
aag cgc gca ctc cag gag gtc tgg gag gag acc aag gac ttt tac att Lys Arg Ala Leu Gln Glu Val Trp Glu Glu Thr Lys Asp Phe Tyr Ile 370 375 380			1152
aac ggt ctc aag aac ccg gag aag atc cag cgc gcc gag cac gac ccc Asn Gly Leu Lys Asn Pro Glu Lys Ile Gln Arg Ala Glu His Asp Pro 385 390 395 400			1200
aag ctc aag atg tcg ctc tgc ttc cgc tgg tac ctt ggt ctt gcc agc Lys Leu Lys Met Ser Leu Cys Phe Arg Trp Tyr Leu Gly Leu Ala Ser 405 410 415			1248
cgc tgg gcc aac atg ggc gcc ccg gac cgc gtc atg gac tac cag gtc Arg Trp Ala Asn Met Gly Ala Pro Asp Arg Val Met Asp Tyr Gln Val 420 425 430			1296
tgg tgt ggc ccg gcc att ggc gcc ttc aac gac ttc atc aag ggc acc Trp Cys Gly Pro Ala Ile Gly Ala Phe Asn Asp Phe Ile Lys Gly Thr 435 440 445			1344
tac ctc gac ccc gct gtc tcc aac gag tac ccc tgt gtc gtc cag atc Tyr Leu Asp Pro Ala Val Ser Asn Glu Tyr Pro Cys Val Val Gln Ile 450 455 460			1392
aac ctg caa atc ctc cgt ggt gcc tgc tac ctg cgc cgt ctc aac gcc Asn Leu Gln Ile Leu Arg Gly Ala Cys Tyr Leu Arg Arg Leu Asn Ala 465 470 475 480			1440
ctg cgc aac gac ccg cgc att gac ctc gag acc gag gat gct gcc ttt Leu Arg Asn Asp Pro Arg Ile Asp Leu Glu Thr Glu Asp Ala Ala Phe 485 490 495			1488
gtc tac gag ccc acc aac gcg ctc Val Tyr Glu Pro Thr Asn Ala Leu 500			1512

<210> 32  
 <211> 504  
 <212> PRT  
 <213> Schizochytrium sp.

<400> 32

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His	Thr	Asp	Val	Ala	Ser	Gly	Gln	Ala	Thr	Ile	Val	Gln	Pro	Cys	Thr
			20					25					30		

Leu Gly Asp Leu Gly Asp Arg Ser Phe Met Glu Thr Tyr Gly Val Val  
 35 40 45

Ala Pro Leu Tyr Thr Gly Ala Met Ala Lys Gly Ile Ala Ser Ala Asp  
 50 55 60

Leu Val Ile Ala Ala Gly Lys Arg Lys Ile Leu Gly Ser Phe Gly Ala  
 65 70 75 80

Gly Gly Leu Pro Met His His Val Arg Ala Ala Leu Glu Lys Ile Gln  
 85 90 95

Ala Ala Leu Pro Gln Gly Pro Tyr Ala Val Asn Leu Ile His Ser Pro  
 100 105 110

Phe Asp Ser Asn Leu Glu Lys Gly Asn Val Asp Leu Phe Leu Glu Lys  
 115 120 125

Gly Val Thr Val Val Glu Ala Ser Ala Phe Met Thr Leu Thr Pro Gln  
 130 135 140

Val Val Arg Tyr Arg Ala Ala Gly Leu Ser Arg Asn Ala Asp Gly Ser  
 145 150 155 160

Val Asn Ile Arg Asn Arg Ile Ile Gly Lys Val Ser Arg Thr Glu Leu  
 165 170 175

Ala Glu Met Phe Ile Arg Pro Ala Pro Glu His Leu Leu Glu Lys Leu  
 180 185 190

Ile Ala Ser Gly Glu Ile Thr Gln Glu Gln Ala Glu Leu Ala Arg Arg  
 195 200 205

Val Pro Val Ala Asp Asp Ile Ala Val Glu Ala Asp Ser Gly Gly His  
 210 215 220

Thr Asp Asn Arg Pro Ile His Val Ile Leu Pro Leu Ile Ile Asn Leu  
 225 230 235 240

Arg Asn Arg Leu His Arg Glu Cys Gly Tyr Pro Ala His Leu Arg Val  
 245 250 255

Arg Val Gly Ala Gly Gly Gly Val Gly Cys Pro Gln Ala Ala Ala Ala  
 260 265 270

Ala Leu Thr Met Gly Ala Ala Phe Ile Val Thr Gly Thr Val Asn Gln  
 275 280 285

Val Ala Lys Gln Ser Gly Thr Cys Asp Asn Val Arg Lys Gln Leu Ser  
 290 295 300

Gln Ala Thr Tyr Ser Asp Ile Cys Met Ala Pro Ala Ala Asp Met Phe  
305 310 315 320

Glu Glu Gly Val Lys Leu Gln Val Leu Lys Lys Gly Thr Met Phe Pro  
325 330 335

Ser Arg Ala Asn Lys Leu Tyr Glu Leu Phe Cys Lys Tyr Asp Ser Phe  
340 345 350

Asp Ser Met Pro Pro Ala Glu Leu Glu Arg Ile Glu Lys Arg Ile Phe  
355 360 365

Lys Arg Ala Leu Gln Glu Val Trp Glu Glu Thr Lys Asp Phe Tyr Ile  
370 375 380

Asn Gly Leu Lys Asn Pro Glu Lys Ile Gln Arg Ala Glu His Asp Pro  
385 390 395 400

Lys Leu Lys Met Ser Leu Cys Phe Arg Trp Tyr Leu Gly Leu Ala Ser  
405 410 415

Arg Trp Ala Asn Met Gly Ala Pro Asp Arg Val Met Asp Tyr Gln Val  
420 425 430

Trp Cys Gly Pro Ala Ile Gly Ala Phe Asn Asp Phe Ile Lys Gly Thr  
435 440 445

Tyr Leu Asp Pro Ala Val Ser Asn Glu Tyr Pro Cys Val Val Gln Ile  
450 455 460

Asn Leu Gln Ile Leu Arg Gly Ala Cys Tyr Leu Arg Arg Leu Asn Ala  
465 470 475 480

Leu Arg Asn Asp Pro Arg Ile Asp Leu Glu Thr Glu Asp Ala Ala Phe  
485 490 495

Val Tyr Glu Pro Thr Asn Ala Leu  
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<210> 33  
<211> 9  
<212> PRT  
<213> Artificial sequence

<220>  
<223> motif

<220>  
<221> MISC\_FEATURE  
<222> (2)..(3)  
<223> Xaa = any amino acid

<220>  
<221> MISC\_FEATURE



<222> (6)..(6)  
<223> Xaa = Ala or Ser

<220>  
<221> MISC\_FEATURE  
<222> (7)..(8)  
<223> Xaa = any amino acid

<400> 33

Trp Xaa Xaa Lys Glu Xaa Xaa Xaa Lys  
1 5

<210> 34  
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<212> PRT  
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<220>  
<223> motif

<220>  
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<222> (1)..(6)  
<223> Xaa = Ile or Leu or Val

<400> 34

Phe Asn Xaa Ser His Ser  
1 5

<210> 35  
<211> 5  
<212> PRT  
<213> Artificial sequence

<220>  
<223> motif

<220>  
<221> MISC\_FEATURE  
<222> (1)..(5)  
<223> Xaa = Ile or Leu or Val

<400> 35

Xaa Gly Xaa Asp Xaa  
1 5

<210> 36  
<211> 4244  
<212> DNA  
<213> Schizochytrium sp.

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ccatcggggcc tcgcctcctc gcgcgcgcacg catcgcgcgc atcgcacgca tcatgctgcc	300
acgcacgggg ggacgcgcgc ccgcggtccc ccgccgcgc cgtcgtcgtc tggcgatgcc	360
gtcgccgccc tccttccttc cctcgcctcc tcttcctccc gagccccct gtcttccttc	420
gccccgcag cggcgcgcag gaagcgagga gagcggggag gagagaagaa aagaaaagaa	480
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agc tca atg atc gag atg gac Ser Ser Met Ile Glu Met Asp 1460	atg gac ctg gag agc gag ctt ggc Met Asp Leu Glu Ser Glu Leu Gly 1465	4419
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 2810

8436

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 <213> Thraustochytrium sp.

<400> 39

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Asp Gly Ile Asp Cys Leu Ser Asp Leu Pro Ala Asp Arg Leu Asp Val  
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Thr Ala Tyr Tyr Asn Pro Asn Lys Ala Thr Lys Asp Lys Ile Tyr Cys  
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Lys Arg Gly Gly Phe Ile Pro Asn Tyr Asp Phe Asp Pro Arg Glu Phe  
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Gly Leu Asn Met Phe Gln Met Glu Asp Ser Asp Ala Asn Gln Thr Leu  
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Thr Leu Leu Lys Val Lys Gln Ala Leu Glu Asp Ala Ser Ile Glu Pro  
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Phe Thr Lys Glu Lys Lys Asn Ile Gly Cys Val Leu Gly Ile Gly Gly  
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Gly Gln Lys Ala Ser His Glu Phe Tyr Ser Arg Leu Asn Tyr Val Val  
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Val Glu Lys Val Leu Arg Lys Met Gly Leu Pro Asp Ala Asp Val Glu  
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Glu Ala Val Glu Lys Tyr Lys Ala Asn Phe Pro Glu Trp Arg Leu Asp  
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Ser Phe Pro Gly Phe Leu Gly Asn Val Thr Ala Gly Arg Cys Ser Asn  
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Thr Phe Asn Met Glu Gly Met Asn Cys Val Val Asp Ala Ala Cys Ala  
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Asp Cys Asp Thr Met Ile Ala Gly Ala Thr Cys Thr Asp Asn Ser Leu  
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Lys Ser Val Ala Gly Phe Ala Gly Leu Val Lys Ala Val Leu Ala Leu  
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Lys His Lys Thr Leu Pro Gly Ser Ile Asn Val Asp Gln Pro Pro Leu  
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Thr Asn Arg Pro Trp Phe Thr Gln Asn Lys Leu Pro Arg Arg Ala Gly  
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Val Ser Ser Phe Gly Phe Gly Gly Ala Asn Tyr His Ala Val Leu Glu  
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Glu Phe Glu Pro Glu His Glu Lys Pro Tyr Arg Leu Asn Thr Val Gly  
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His Pro Val Leu Leu Tyr Ala Pro Ser Val Glu Ala Leu Lys Val Leu  
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Cys Asn Asp Gln Leu Ala Glu Leu Thr Ile Ala Leu Glu Glu Ala Lys  
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Thr His Lys Asn Val Asp Lys Val Cys Gly Tyr Lys Phe Ile Asp Glu  
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Phe Gln Leu Gln Gly Ser Cys Pro Pro Glu Asn Pro Arg Val Gly Phe  
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Leu Ala Thr Leu Pro Thr Ser Asn Ile Ile Val Ala Leu Lys Ala Ile  
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Leu Ala Gln Leu Asp Ala Lys Pro Asp Ala Lys Lys Trp Asp Leu Pro  
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His Lys Lys Ala Phe Gly Ala Thr Phe Ala Ser Ser Ser Val Lys Gly  
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Ser Val Ala Ala Leu Phe Ala Gly Gln Gly Thr Gln Tyr Leu Asn Met  
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Phe Ser Asp Val Ala Met Asn Trp Pro Pro Phe Arg Asp Ser Ile Val  
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Gln Gly Asn Glu Leu Leu Cys Leu Thr Glu Tyr Ser Gln Pro Thr Thr  
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Lys Pro Asp Met Val Gly Gly His Ser Leu Gly Glu Phe Ala Ala Leu  
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Tyr Ala Ala Gly Ser Ile Ser Arg Asp Asp Leu Tyr Lys Leu Val Cys  
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Lys Arg Ala Lys Ala Met Ala Asn Ala Ser Asp Gly Ala Met Ala Ala  
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Ser Pro Asn Pro Lys Gln Thr Leu Lys Ser His Met Thr Ser Ser Val  
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Gln Phe Glu Glu Gln Ile Arg Asn Met Tyr Asp Ala Gly Ala Arg Val  
850 855 860

Phe Leu Glu Phe Gly Pro Arg Gln Val Leu Ala Lys Leu Ile Ala Glu  
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Asp Ser Asp Val Gln Leu Arg Leu Ala Ala Val Lys Phe Ala Val Ser  
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Ala Thr Tyr Val Ser Pro Lys Thr Leu Ala Glu Arg Lys Lys Ala Met  
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Ile Gly Lys Ile Ala Gln Glu Val Arg Thr Ala Lys Gln Pro Leu Glu  
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Thr Glu Ile Arg Arg Leu Asn Lys Glu Leu Glu His Leu Lys Arg Glu  
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Leu Ala Ala Ala Lys Ala Ser Val Lys Ser Ala Ser Lys Ser Ser  
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Lys Glu Arg Ser Val Leu Ser Lys His Arg Ala Leu Leu Gln Asn  
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1190						1195					1200			
Ser	Ser	Ala	Arg	Leu	Ala	Glu	Ala	Glu	Ala	Ala	Val	Leu	Ser	Val
1205						1210					1215			
Leu	Ala	Asp	Lys	Thr	Gly	Tyr	Asp	Ser	Ser	Met	Ile	Glu	Met	Asp
1220						1225					1230			
Met	Asp	Leu	Glu	Ser	Glu	Leu	Gly	Val	Asp	Ser	Ile	Lys	Arg	Val
1235						1240					1245			
Glu	Ile	Met	Ser	Glu	Val	Gln	Thr	Leu	Leu	Ser	Val	Glu	Val	Ser
1250						1255					1260			
Asp	Val	Asp	Ala	Leu	Ser	Arg	Thr	Lys	Thr	Val	Gly	Asp	Val	Ile
1265						1270					1275			
Glu	Ala	Met	Lys	Leu	Glu	Leu	Gly	Gly	Pro	Gln	Gly	Gln	Thr	Leu
1280						1285					1290			

Thr Ala Glu Ser Ile Arg Gln Pro Pro Val Ser Glu Pro Ala Val  
 1295 1300 1305  
 Pro Thr Ser Ser Ser Ser Ser Ile Ala Asn Val Ser Ser Ala Arg  
 1310 1315 1320  
 Leu Ala Glu Ala Glu Ala Ala Val Leu Ser Val Leu Ala Asp Lys  
 1325 1330 1335  
 Thr Gly Tyr Asp Ser Ser Met Ile Glu Met Asp Met Asp Leu Glu  
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 Ser Glu Leu Gly Val Asp Ser Ile Lys Arg Val Glu Ile Met Ser  
 1355 1360 1365  
 Glu Val Gln Thr Leu Leu Ser Val Glu Val Ser Asp Val Asp Ala  
 1370 1375 1380  
 Leu Ser Arg Thr Lys Thr Val Gly Asp Val Ile Glu Ala Met Lys  
 1385 1390 1395  
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 1400 1405 1410  
 Ile Arg Gln Pro Pro Val Ser Glu Pro Ala Val Pro Thr Ser Ser  
 1415 1420 1425  
 Ser Ser Ser Ile Ala Asn Val Leu Ser Ala Arg Leu Ala Glu Ala  
 1430 1435 1440  
 Glu Ala Ala Val Leu Ser Val Leu Ala Asp Lys Thr Gly Tyr Asp  
 1445 1450 1455  
 Ser Ser Met Ile Glu Met Asp Met Asp Leu Glu Ser Glu Leu Gly  
 1460 1465 1470  
 Val Asp Ser Ile Lys Arg Val Glu Ile Met Ser Glu Val Gln Thr  
 1475 1480 1485  
 Leu Leu Ser Val Glu Val Ser Asp Val Asp Ala Leu Ser Arg Thr  
 1490 1495 1500  
 Lys Thr Val Gly Asp Val Ile Glu Ala Met Lys Leu Glu Leu Gly  
 1505 1510 1515  
 Gly Pro Gln Gly Gln Thr Leu Thr Ala Glu Ser Ile Arg Gln Pro  
 1520 1525 1530  
 Pro Val Ser Glu Pro Ala Val Pro Thr Ser Ser Ser Ser Ile  
 1535 1540 1545

123

Gly	Tyr	Asp	Ser	Ser	Met	Ile	Glu	Met	Asp	Met	Asp	Leu	Glu	Ser
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Glu	Leu	Gly	Val	Asp	Ser	Ile	Lys	Arg	Val	Glu	Ile	Met	Ser	Glu
1820						1825					1830			
Val	Gln	Ala	Leu	Leu	Ser	Val	Glu	Val	Ser	Asp	Val	Asp	Ala	Leu
1835						1840					1845			
Ser	Arg	Thr	Lys	Thr	Val	Gly	Asp	Val	Ile	Glu	Ala	Met	Lys	Met
1850						1855					1860			
Glu	Leu	Gly	Gly	Pro	Gln	Gly	Gln	Thr	Leu	Thr	Ala	Glu	Ser	Ile
1865						1870					1875			
Arg	Glu	Pro	Pro	Val	Ser	Glu	Pro	Ala	Val	Pro	Thr	Ser	Ser	Ser
1880						1885					1890			
Ser	Ser	Ile	Ala	Asn	Val	Ser	Ser	Ala	Arg	Leu	Ala	Glu	Ala	Glu
1895						1900					1905			
Ala	Ala	Val	Leu	Ser	Val	Leu	Ala	Asp	Lys	Thr	Gly	Tyr	Asp	Ser
1910						1915					1920			
Ser	Met	Ile	Glu	Met	Asp	Met	Asp	Leu	Glu	Ser	Glu	Leu	Gly	Val
1925						1930					1935			
Asp	Ser	Ile	Lys	Arg	Val	Glu	Ile	Met	Ser	Glu	Val	Gln	Thr	Leu
1940						1945					1950			
Leu	Ser	Val	Glu	Val	Ser	Asp	Val	Asp	Ala	Leu	Ser	Arg	Thr	Lys
1955						1960					1965			
Thr	Val	Gly	Asp	Val	Ile	Glu	Ala	Met	Lys	Leu	Glu	Leu	Gly	Glu
1970						1975					1980			
Ser	Ser	Ser	Ile	Glu	Thr	Leu	Asn	Cys	Thr	Glu	Val	Glu	His	Thr
1985						1990					1995			
Ser	Tyr	Lys	Ser	Val	Lys	Ala	Ser	Gly	Cys	Glu	Asn	Val	Asp	Thr
2000						2005					2010			
Arg	Phe	Ala	Lys	Val	Val	Gln	Ile	Ser	Leu	Pro	Ser	Lys	Leu	Lys
2015						2020					2025			
Ser	Thr	Val	Ser	His	Asp	Arg	Pro	Val	Ile	Val	Val	Asp	Asp	Gly
2030						2035					2040			
Thr	Pro	Leu	Thr	Thr	Glu	Leu	Cys	Lys	Ile	Leu	Gly	Gly	Asp	Ile
2045						2050					2055			



Val	Val	Leu	Ser	Tyr	Gln	Gly	Lys	Pro	Ala	Gly	Pro	Arg	Gly	Val
2060						2065					2070			
Glu	Val	Pro	Asp	Leu	Ser	Glu	Glu	Ala	Leu	Ile	Gln	Ala	Leu	Ala
2075						2080					2085			
Leu	Ile	Arg	Ser	Thr	Tyr	Gly	Val	Pro	Ile	Gly	Phe	Ile	Cys	Gln
2090						2095					2100			
Gln	Val	Ser	Asn	Val	Ser	Thr	Lys	Ala	Gln	Leu	Cys	Trp	Ala	Leu
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Leu	Ala	Ala	Lys	His	Leu	Lys	Lys	Asp	Leu	Asn	Ala	Val	Leu	Pro
2120						2125					2130			
Asp	Ser	Arg	Ser	Phe	Phe	Val	Gly	Val	Val	Arg	Leu	Asn	Gly	Lys
2135						2140					2145			
Leu	Gly	Thr	Phe	Glu	Asn	Ile	Ser	Asp	Phe	Ser	Lys	Phe	Asp	Leu
2150						2155					2160			
Thr	Lys	Ala	Leu	Asp	Tyr	Gly	Gln	Arg	Gly	Ser	Leu	Leu	Gly	Leu
2165						2170					2175			
Cys	Lys	Ser	Leu	Asp	Leu	Glu	Trp	Glu	Gln	Val	Phe	Cys	Arg	Gly
2180						2185					2190			
Ile	Asp	Leu	Ala	Cys	Asp	Leu	Met	Pro	Leu	Gln	Ala	Ala	Arg	Ile
2195						2200					2205			
Leu	Arg	Asn	Glu	Leu	Gln	Cys	Pro	Asn	Met	Arg	Leu	Arg	Glu	Val
2210						2215					2220			
Gly	Tyr	Asp	Ile	Ser	Gly	Ala	Arg	Tyr	Thr	Ile	Ser	Thr	Asp	Asp
2225						2230					2235			
Leu	Leu	Cys	Gly	Pro	Ser	Lys	Ala	Lys	Val	Glu	Ala	Ala	Asp	Leu
2240						2245					2250			
Phe	Leu	Val	Thr	Gly	Gly	Ala	Arg	Gly	Ile	Thr	Pro	His	Cys	Val
2255						2260					2265			
Arg	Glu	Ile	Ala	Ser	Arg	Ser	Pro	Gly	Thr	Thr	Phe	Val	Leu	Val
2270						2275					2280			
Gly	Arg	Ser	Glu	Met	Ser	Asp	Glu	Pro	Asp	Trp	Ala	Val	Gly	His
2285						2290					2295			
Tyr	Asn	Lys	Asp	Leu	Asp	Gln	Ser	Thr	Met	Lys	His	Leu	Lys	Ala
2300						2305					2310			

Thr	His	Ala	Ala	Gly	Gly	Val	Lys	Pro	Thr	Pro	Lys	Ala	His	Arg
2315						2320					2325			
Ala	Leu	Val	Asn	Arg	Val	Thr	Gly	Ser	Arg	Glu	Val	Arg	Glu	Ser
2330						2335					2340			
Leu	Arg	Ala	Ile	Gln	Glu	Ala	Gly	Ala	Asn	Val	Glu	Tyr	Ile	Ala
2345						2350					2355			
Cys	Asp	Val	Ser	Asp	Glu	Asn	Lys	Val	Arg	Gln	Leu	Val	Gln	Arg
2360						2365					2370			
Val	Glu	Gln	Lys	Tyr	Gly	Cys	Glu	Ile	Thr	Gly	Ile	Trp	His	Ala
2375						2380					2385			
Ser	Gly	Val	Leu	Arg	Asp	Lys	Leu	Val	Glu	Gln	Lys	Thr	Thr	Asp
2390						2395					2400			
Asp	Phe	Glu	Ala	Val	Phe	Gly	Thr	Lys	Val	Thr	Gly	Leu	Val	Asn
2405						2410					2415			
Ile	Val	Ser	Gln	Val	Asn	Met	Ser	Lys	Leu	Arg	His	Phe	Ile	Leu
2420						2425					2430			
Phe	Ser	Ser	Leu	Ala	Gly	Phe	His	Gly	Asn	Lys	Gly	Gln	Thr	Asp
2435						2440					2445			
Tyr	Ala	Ile	Ala	Asn	Glu	Ala	Leu	Asn	Lys	Ile	Ala	His	Thr	Leu
2450						2455					2460			
Ser	Ala	Phe	Leu	Pro	Lys	Leu	Asn	Ala	Lys	Val	Leu	Asp	Phe	Gly
2465						2470					2475			
Pro	Trp	Val	Gly	Ser	Gly	Met	Val	Thr	Glu	Thr	Leu	Glu	Lys	His
2480						2485					2490			
Phe	Lys	Ala	Met	Gly	Val	Gln	Thr	Ile	Pro	Leu	Glu	Pro	Gly	Ala
2495						2500					2505			
Arg	Thr	Val	Ala	Gln	Ile	Ile	Leu	Ala	Ser	Ser	Pro	Pro	Gln	Ser
2510						2515					2520			
Leu	Leu	Gly	Asn	Trp	Gly	Phe	Pro	Ala	Thr	Lys	Pro	Leu	Gln	Arg
2525						2530					2535			
Ser	Asn	Val	Val	Thr	Gly	Thr	Leu	Ser	Pro	Glu	Glu	Ile	Glu	Phe
2540						2545					2550			
Ile	Ala	Asp	His	Lys	Ile	Gln	Gly	Arg	Lys	Val	Leu	Pro	Met	Met
2555						2560					2565			

Ala	Ala	Ile	Gly	Phe	Met	Ala	Ser	Ile	Ala	Glu	Gly	Leu	Tyr	Pro
2570						2575					2580			
Gly	Tyr	Asn	Leu	Gln	Gly	Val	Glu	Asn	Ala	Gln	Leu	Phe	Gln	Gly
2585						2590					2595			
Leu	Thr	Ile	Asn	Gln	Glu	Thr	Lys	Phe	Gln	Ile	Thr	Leu	Ile	Glu
2600						2605					2610			
Glu	His	Asn	Ser	Glu	Glu	Asn	Leu	Asp	Val	Leu	Thr	Ser	Leu	Gly
2615						2620					2625			
Val	Met	Leu	Glu	Ser	Gly	Lys	Val	Leu	Pro	Ala	Tyr	Arg	Cys	Val
2630						2635					2640			
Val	Cys	Leu	Asn	Thr	Thr	Gln	Gln	Gln	Pro	Lys	Leu	Ser	Pro	Lys
2645						2650					2655			
Ile	Leu	Asn	Leu	Glu	Val	Asp	Pro	Ala	Cys	Glu	Val	Asn	Pro	Tyr
2660						2665					2670			
Asp	Gly	Lys	Ser	Leu	Phe	His	Gly	Pro	Leu	Leu	Gln	Phe	Val	Gln
2675						2680					2685			
Gln	Val	Leu	His	Ser	Ser	Thr	Lys	Gly	Leu	Val	Ala	Lys	Cys	Arg
2690						2695					2700			
Ala	Leu	Pro	Ile	Lys	Glu	Ala	Ile	Arg	Gly	Pro	Phe	Ile	Lys	Gln
2705						2710					2715			
Thr	Leu	His	Asp	Pro	Ile	Leu	Asp	Asp	Val	Ile	Phe	Gln	Leu	Met
2720						2725					2730			
Leu	Val	Trp	Cys	Arg	Asn	Ala	Leu	Gly	Ser	Ala	Ser	Leu	Pro	Asn
2735						2740					2745			
Arg	Ile	Glu	Lys	Met	Ser	Tyr	Phe	Gly	Asn	Val	Ser	Glu	Gly	Ser
2750						2755					2760			
Thr	Phe	Phe	Ala	Ser	Val	Thr	Pro	Val	Gly	Pro	Arg	Val	Pro	Lys
2765						2770					2775			
Asp	Pro	Val	Ile	Lys	Met	Gln	Phe	Leu	Leu	Gln	Asp	Glu	Ser	Gly
2780						2785					2790			
Asn	Thr	Phe	Ser	Ser	Gly	Glu	Gly	Ser	Val	Val	Leu	Ser	Asp	Glu
2795						2800					2805			
Leu	Val	Phe												
2810														

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 <212> DNA  
 <213> Thraustochytrium sp.

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 Met Lys Asp Met Glu Asp Arg Arg Val Ala Ile Val Gly Met Ser Ala  
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cac ttg cct tgt ggg aca gat gtg aag gaa tca tgg cag gct att cgc 96  
 His Leu Pro Cys Gly Thr Asp Val Lys Glu Ser Trp Gln Ala Ile Arg  
 20 25 30

gat gga atc gac tgt cta agt gac cta ccc gcg gat cgt ctc gac gtt 144  
 Asp Gly Ile Asp Cys Leu Ser Asp Leu Pro Ala Asp Arg Leu Asp Val  
 35 40 45

aca gct tac tac aat ccc aac aaa gcc acg aaa gac aag atc tac tgc 192  
 Thr Ala Tyr Tyr Asn Pro Asn Lys Ala Thr Lys Asp Lys Ile Tyr Cys  
 50 55 60

aaa cgg ggt ggc ttc atc ccg aac tat gac ttc gac ccc cgc gaa ttt 240  
 Lys Arg Gly Gly Phe Ile Pro Asn Tyr Asp Phe Asp Pro Arg Glu Phe  
 65 70 75 80

ggg ctc aac atg ttt caa atg gaa gac tct gat gcg aat cag aca ctt 288  
 Gly Leu Asn Met Phe Gln Met Glu Asp Ser Asp Ala Asn Gln Thr Leu  
 85 90 95

acc ttg ctc aaa gtc aaa caa gct ctc gaa gat gca agc ata gag cct 336  
 Thr Leu Leu Lys Val Lys Gln Ala Leu Glu Asp Ala Ser Ile Glu Pro  
 100 105 110

ttc acc aag gag aag aag aac att gga tgt gtt tta ggt att ggt ggg 384  
 Phe Thr Lys Glu Lys Lys Asn Ile Gly Cys Val Leu Gly Ile Gly Gly  
 115 120 125

ggc caa aag gcg agt cat gag ttc tac tct cgt ctc aac tac gtt gtc 432  
 Gly Gln Lys Ala Ser His Glu Phe Tyr Ser Arg Leu Asn Tyr Val Val  
 130 135 140

gtt gaa aag gta ctt cgg aaa atg ggt tta cca gat gct gat gtt gaa 480  
 Val Glu Lys Val Leu Arg Lys Met Gly Leu Pro Asp Ala Asp Val Glu  
 145 150 155 160

gaa gct gtg gag aaa tac aag gca aat ttt ccc gag tgg cgc cta gac 528  
 Glu Ala Val Glu Lys Tyr Lys Ala Asn Phe Pro Glu Trp Arg Leu Asp  
 165 170 175

tct ttc cct ggg ttt ctt ggg aat gta acg gct ggt cgg tgc agt aac 576  
 Ser Phe Pro Gly Phe Leu Gly Asn Val Thr Ala Gly Arg Cys Ser Asn  
 180 185 190

acc ttc aac atg gaa ggt atg aac tgc gtt gtg gat gct gca tgt gcc 624  
 Thr Phe Asn Met Glu Gly Met Asn Cys Val Val Asp Ala Ala Cys Ala  
 195 200 205

agt tct cta att gca atc aag gtt gca gtt gaa gag cta ctc ttt ggt 672  
 Ser Ser Leu Ile Ala Ile Lys Val Ala Val Glu Glu Leu Leu Phe Gly  
 210 215 220

gac tgt gac acc atg att gca ggt gcc acc tgc acg gac aat tca ctt 720

Asp 225	Cys	Asp	Thr	Met	Ile 230	Ala	Gly	Ala	Thr	Cys 235	Thr	Asp	Asn	Ser	Leu 240	
ggc Gly	atg Met	tac Tyr	atg Met	gcc Ala	ttc Phe	tct Ser	aaa Lys	acg Thr	cca Pro	gtt Val	ttt Phe	tct Ser	act Thr	gac Asp	cca Pro	768
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ggc Gly	tca Ser	gca Ala	atg Met	ttc Phe	gtt Val	ctt Leu	aaa Lys	cgc Arg	tat Tyr	gcg Ala	gat Asp	gcc Ala	gta Val	cgt Arg	gat Asp	864
ggc Gly	gac Asp	aca Thr	att Ile	cac His	gcg Ala	gtt Leu	ctg Arg	cgt Ser	tct Cys	tgc Ser	tct Ser	tcg Ser	tct Ser	agt Ser	gat Asp	912
gga Gly	aaa Lys	gcg Ala	gca Ala	gga Gly	att Ile	tat Tyr	act Thr	cct Pro	act Thr	ata Ile	tct Ser	gga Gly	caa Gln	gaa Glu	gaa Glu	960
gct Ala	ttg Leu	cgt Arg	cga Arg	gcg Ala	tat Tyr	gcc Ala	cgt Arg	gcg Ala	ggg Gly	gta Val	tgt Cys	cca Pro	tct Ser	acg Thr	atc Ile	1008
ggg Gly	ctt Leu	gtt Val	gag Glu	ggc Gly	cac His	ggg Gly	aca Thr	ggg Gly	acc Thr	cct Pro	gtt Val	gga Gly	gat Asp	cgc Arg	att Ile	1056
gag Glu	tta Leu	aca Thr	gct Ala	ctg Leu	cgg Arg	aac Asn	ttg Leu	ttt Phe	gac Asp	aaa Lys	gct Ala	ttt Phe	ggc Gly	agc Ser	aag Lys	1104
aag Lys	gaa Glu	caa Gln	ata Ile	gca Ala	gtt Val	ggc Gly	agc Ser	ata Ile	aag Lys	tct Ser	cag Gln	ata Ile	ggc Gly	cac His	ctg Leu	1152
aaa Lys	tct Ser	gtt Val	gcc Ala	ggc Gly	ttt Phe	gcc Ala	ggc Gly	ttg Leu	gtc Val	aaa Lys	gct Ala	gtg Val	ctt Leu	gcg Ala	ctt Leu	1200
aaa Lys	cac His	aaa Lys	acg Thr	ctc Leu	cca Pro	ggc Gly	tcg Ser	att Ile	aat Asn	gtc Val	gac Asp	cag Gln	cca Pro	cct Pro	ttg Leu	1248
ttg Leu	tat Tyr	gac Asp	ggc Gly	act Thr	caa Gln	att Ile	caa Gln	gac Asp	tct Ser	tct Ser	tta Leu	tat Tyr	atc Ile	aac Asn	aag Lys	1296
aca Thr	aat Asn	aga Arg	cca Pro	tgg Trp	ttt Phe	acg Thr	caa Gln	aac Asn	aag Lys	ctt Leu	ccg Pro	cgt Arg	cgg Arg	gct Ala	ggc Gly	1344
gtc Val	tca Ser	agt Ser	ttt Phe	gga Gly	ttt Phe	gga Gly	ggc Gly	gca Ala	aac Asn	tac Tyr	cac His	gcg Ala	gtt Val	ctg Leu	gaa Glu	1392
gaa Glu	ttc Phe	gag Glu	ccc Pro	gag Glu	cat His	gaa Glu	aaa Lys	cca Pro	tac Tyr	cgc Arg	ctc Leu	aat Asn	act Thr	gtt Val	gga Gly	1440
cat His	cct Pro	gtc Val	ctc Leu	ttg Leu	tac Tyr	gct Ala	ccg Pro	tct Ser	gtg Val	gaa Glu	gcc Ala	ctc Leu	aaa Lys	gta Val	ctt Leu	1488
tgc Leu	aac Pro	gac Val	cag Leu													1500

Cys Asn Asp Gln  
500

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<212> PRT  
<213> Thraustochytrium sp.

<400> 41

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His Leu Pro Cys Gly Thr Asp Val Lys Glu Ser Trp Gln Ala Ile Arg  
20 25 30

Asp Gly Ile Asp Cys Leu Ser Asp Leu Pro Ala Asp Arg Leu Asp Val  
35 40 45

Thr Ala Tyr Tyr Asn Pro Asn Lys Ala Thr Lys Asp Lys Ile Tyr Cys  
50 55 60

Lys Arg Gly Gly Phe Ile Pro Asn Tyr Asp Phe Asp Pro Arg Glu Phe  
65 70 75 80

Gly Leu Asn Met Phe Gln Met Glu Asp Ser Asp Ala Asn Gln Thr Leu  
85 90 95

Thr Leu Leu Lys Val Lys Gln Ala Leu Glu Asp Ala Ser Ile Glu Pro  
100 105 110

Phe Thr Lys Glu Lys Lys Asn Ile Gly Cys Val Leu Gly Ile Gly Gly  
115 120 125

Gly Gln Lys Ala Ser His Glu Phe Tyr Ser Arg Leu Asn Tyr Val Val  
130 135 140

Val Glu Lys Val Leu Arg Lys Met Gly Leu Pro Asp Ala Asp Val Glu  
145 150 155 160

Glu Ala Val Glu Lys Tyr Lys Ala Asn Phe Pro Glu Trp Arg Leu Asp  
165 170 175

Ser Phe Pro Gly Phe Leu Gly Asn Val Thr Ala Gly Arg Cys Ser Asn  
180 185 190

Thr Phe Asn Met Glu Gly Met Asn Cys Val Val Asp Ala Ala Cys Ala  
195 200 205

Ser Ser Leu Ile Ala Ile Lys Val Ala Val Glu Glu Leu Leu Phe Gly  
210 215 220

Asp Cys Asp Thr Met Ile Ala Gly Ala Thr Cys Thr Asp Asn Ser Leu

225		230		235		240
Gly Met Tyr Met	Ala Phe Ser Lys Thr	Pro Val Phe Ser Thr	Asp Pro			
	245	250	255			
Ser Val Arg Ala	Tyr Asp Glu Lys Thr	Lys Gly Met Leu Ile	Gly Glu			
	260	265	270			
Gly Ser Ala Met	Phe Val Leu Lys Arg Tyr	Ala Asp Ala Val Arg	Asp			
	275	280	285			
Gly Asp Thr Ile	His Ala Val Leu Arg Ser	Cys Ser Ser Ser	Asp			
	290	295	300			
Gly Lys Ala Ala	Gly Ile Tyr Thr Pro Thr	Ile Ser Gly Gln Glu	Glu			
	305	310	315	320		
Ala Leu Arg Arg	Ala Tyr Ala Arg Ala	Gly Val Cys Pro Ser	Thr Ile			
	325	330	335			
Gly Leu Val Glu	Gly His Gly Thr Gly	Thr Pro Val Gly	Asp Arg Ile			
	340	345	350			
Glu Leu Thr Ala	Leu Arg Asn Leu Phe	Asp Lys Ala Phe	Gly Ser Lys			
	355	360	365			
Lys Glu Gln Ile	Ala Val Gly Ser Ile	Lys Ser Gln Ile	Gly His Leu			
	370	375	380			
Lys Ser Val Ala	Gly Phe Ala Gly Leu	Val Lys Ala Val	Leu Ala Leu			
	385	390	395	400		
Lys His Lys Thr	Leu Pro Gly Ser Ile	Asn Val Asp Gln	Pro Pro Leu			
	405	410	415			
Leu Tyr Asp Gly	Thr Gln Ile Gln Asp	Ser Ser Leu Tyr	Ile Asn Lys			
	420	425	430			
Thr Asn Arg Pro	Trp Phe Thr Gln	Asn Lys Leu Pro	Arg Arg Ala Gly			
	435	440	445			
Val Ser Ser Phe	Gly Phe Gly Gly	Ala Asn Tyr His	Ala Val Leu Glu			
	450	455	460			
Glu Phe Glu Pro	Glu His Glu Lys Pro	Tyr Arg Leu Asn	Thr Val Gly			
	465	470	475	480		
His Pro Val Leu	Leu Tyr Ala Pro Ser	Val Glu Ala Leu	Lys Val Leu			
	485	490	495			
Cys Asn Asp Gln						

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 gtt gac aaa gtt tgt ggc tac aag ttt att gac gaa ttt cag ctc caa 96  
 Val Asp Lys Val Cys Gly Tyr Lys Phe Ile Asp Glu Phe Gln Leu Gln  
 20 25 30  
 gga agc tgt cct cca gaa aat ccg aga gta gga ttt tta gca aca ctg 144  
 Gly Ser Cys Pro Pro Glu Asn Pro Arg Val Gly Phe Leu Ala Thr Leu  
 35 40 45  
 cct act tca aat atc att gtc gcg ctt aag gca att ctc gcg cag ctt 192  
 Pro Thr Ser Asn Ile Ile Val Ala Leu Lys Ala Ile Leu Ala Gln Leu  
 50 55 60  
 gat gca aaa cca gat gcg aag aaa tgg gat ttg cct cat aaa aag gct 240  
 Asp Ala Lys Pro Asp Ala Lys Lys Trp Asp Leu Pro His Lys Lys Ala  
 65 70 75 80  
 ttt ggg gct acc ttc gca tcg tct tca gtg aaa ggc tct gtt gct gcg 288  
 Phe Gly Ala Thr Phe Ala Ser Ser Ser Val Lys Gly Ser Val Ala Ala  
 85 90 95  
 ctc ttc gca gga cag ggt acc cag tac tta aac atg ttc tct gat gtg 336  
 Leu Phe Ala Gly Gln Gly Thr Gln Tyr Leu Asn Met Phe Ser Asp Val  
 100 105 110  
 gca atg aac tgg cca ccg ttc cgt gac agc att gtc gca atg gaa gaa 384  
 Ala Met Asn Trp Pro Pro Phe Arg Asp Ser Ile Val Ala Met Glu Glu  
 115 120 125  
 gct caa act gag gta ttt gag ggc caa gtt gaa cca att agc aaa gtt 432  
 Ala Gln Thr Glu Val Phe Glu Gly Gln Val Glu Pro Ile Ser Lys Val  
 130 135 140  
 ctg ttt cca cga gag cgc tat gca tcc gaa agt gaa cag ggg aat gaa 480  
 Leu Phe Pro Arg Glu Arg Tyr Ala Ser Glu Ser Glu Gln Gly Asn Glu  
 145 150 155 160  
 ctt ctt tgc tta aca gag tac tct cag cca act acg ata gca gcc gca 528  
 Leu Leu Cys Leu Thr Glu Tyr Ser Gln Pro Thr Thr Ile Ala Ala Ala  
 165 170 175  
 gta ggg gcc ttc gat att ttc aaa gcg gct ggc ttt aag cca gac atg 576  
 Val Gly Ala Phe Asp Ile Phe Lys Ala Ala Gly Phe Lys Pro Asp Met  
 180 185 190  
 gtt gga ggg cat tca ctt ggc gaa ttt gct gct ttg tac gcg gct ggg 624  
 Val Gly Gly His Ser Leu Gly Glu Phe Ala Ala Leu Tyr Ala Ala Gly  
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 tcc att tcg cgt gac gac ctg tac aag ctt gtg tgc aaa cgg gca aag 672  
 Ser Ile Ser Arg Asp Asp Leu Tyr Lys Leu Val Cys Lys Arg Ala Lys



210	215	220	
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gat gca cgt cta gtt acg cca caa aat agt gac gtt tat gtc gca aac Asp Ala Arg Leu Val Thr Pro Gln Asn Ser Asp Val Tyr Val Ala Asn 245 250 255			768
ttc aac tcc gca act caa gta gtc atc agt ggc act gtt caa ggt gtg Phe Asn Ser Ala Thr Gln Val Val Ile Ser Gly Thr Val Gln Gly Val 260 265 270			816
aaa gaa gag tcg aaa ttg ctc att tca aag ggg ttc cgc gta ctg cca Lys Glu Glu Ser Lys Leu Leu Ile Ser Lys Gly Phe Arg Val Leu Pro 275 280 285			864
ctt aaa tgc cag ggc gcc ttc cat tct cct ttg atg ggg cct tct gag Leu Lys Cys Gln Gly Ala Phe His Ser Pro Leu Met Gly Pro Ser Glu 290 295 300			912
gat agt ttc aaa tca ctt gtg gag act tgt acc atc tcg ccg cca aaa Asp Ser Phe Lys Ser Leu Val Glu Thr Cys Thr Ile Ser Pro Pro Lys 305 310 315 320			960
aat gtg aaa ttc ttt tgc aat gtt agt ggc aag gaa agc cca aac cca Asn Val Lys Phe Phe Cys Asn Val Ser Gly Lys Glu Ser Pro Asn Pro 325 330 335			1008
aaa cag acc ctc aag tca cac atg acg tct agc gtt cag ttc gag gag Lys Gln Thr Leu Lys Ser His Met Thr Ser Ser Val Gln Phe Glu Glu 340 345 350			1056
cag att cgt aac atg tac gat gcc gga gca cgt gtt ttt ctg gag ttt Gln Ile Arg Asn Met Tyr Asp Ala Gly Ala Arg Val Phe Leu Glu Phe 355 360 365			1104
gga ccc cgc caa gtc ctt gca aag ctt atc gcg gaa atg ttt ccc tcg Gly Pro Arg Gln Val Leu Ala Lys Leu Ile Ala Glu Met Phe Pro Ser 370 375 380			1152
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caa ctc cgc ctc gcc gcc gta aaa ttc gcg gtc tcg ggt gca gcc ctt Gln Leu Arg Leu Ala Ala Val Lys Phe Ala Val Ser Gly Ala Ala Leu 405 410 415			1248
agc acc ttt gat cca tgg gag tat cgc aag cca caa gat ctt ctt att Ser Thr Phe Asp Pro Trp Glu Tyr Arg Lys Pro Gln Asp Leu Leu Ile 420 425 430			1296
cga aaa cca cga aaa act gcc ctt gtt cta tca gca gca aca tat gtt Arg Lys Pro Arg Lys Thr Ala Leu Val Leu Ser Ala Ala Thr Tyr Val 435 440 445			1344
tcc cca aag act ctt gca gaa cgt aaa aag gct atg gaa gat atc aag Ser Pro Lys Thr Leu Ala Glu Arg Lys Lys Ala Met Glu Asp Ile Lys 450 455 460			1392
cta gta tcc att aca cca aga gat agt atg gta tca att gga aaa atc Leu Val Ser Ile Thr Pro Arg Asp Ser Met Val Ser Ile Gly Lys Ile 465 470 475 480			1440
gcg caa gaa gta cgg aca gct aaa cag cct tta gaa acc gaa att cga Ala Gln Glu Val Arg Thr Ala Lys Gln Pro Leu Glu Thr Glu Ile Arg 485 490 495			1488

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 Gly Ser Cys Pro Pro Glu Asn Pro Arg Val Gly Phe Leu Ala Thr Leu  
 35 40 45  
  
 Pro Thr Ser Asn Ile Ile Val Ala Leu Lys Ala Ile Leu Ala Gln Leu  
 50 55 60  
  
 Asp Ala Lys Pro Asp Ala Lys Lys Trp Asp Leu Pro His Lys Lys Ala  
 65 70 75 80  
  
 Phe Gly Ala Thr Phe Ala Ser Ser Ser Val Lys Gly Ser Val Ala Ala  
 85 90 95  
  
 Leu Phe Ala Gly Gln Gly Thr Gln Tyr Leu Asn Met Phe Ser Asp Val  
 100 105 110  
  
 Ala Met Asn Trp Pro Pro Phe Arg Asp Ser Ile Val Ala Met Glu Glu  
 115 120 125  
  
 Ala Gln Thr Glu Val Phe Glu Gly Gln Val Glu Pro Ile Ser Lys Val  
 130 135 140  
  
 Leu Phe Pro Arg Glu Arg Tyr Ala Ser Glu Ser Glu Gln Gly Asn Glu  
 145 150 155 160  
  
 Leu Leu Cys Leu Thr Glu Tyr Ser Gln Pro Thr Thr Ile Ala Ala Ala  
 165 170 175  
  
 Val Gly Ala Phe Asp Ile Phe Lys Ala Ala Gly Phe Lys Pro Asp Met  
 180 185 190  
  
 Val Gly Gly His Ser Leu Gly Glu Phe Ala Ala Leu Tyr Ala Ala Gly  
 195 200 205  
  
 Ser Ile Ser Arg Asp Asp Leu Tyr Lys Leu Val Cys Lys Arg Ala Lys  
 210 215 220

Ala Met Ala Asn Ala Ser Asp Gly Ala Met Ala Ala Val Ile Gly Pro  
 225 230 235 240  
 Asp Ala Arg Leu Val Thr Pro Gln Asn Ser Asp Val Tyr Val Ala Asn  
 245 250 255  
 Phe Asn Ser Ala Thr Gln Val Val Ile Ser Gly Thr Val Gln Gly Val  
 260 265 270  
 Lys Glu Glu Ser Lys Leu Leu Ile Ser Lys Gly Phe Arg Val Leu Pro  
 275 280 285  
 Leu Lys Cys Gln Gly Ala Phe His Ser Pro Leu Met Gly Pro Ser Glu  
 290 295 300  
 Asp Ser Phe Lys Ser Leu Val Glu Thr Cys Thr Ile Ser Pro Pro Lys  
 305 310 315 320  
 Asn Val Lys Phe Phe Cys Asn Val Ser Gly Lys Glu Ser Pro Asn Pro  
 325 330 335  
 Lys Gln Thr Leu Lys Ser His Met Thr Ser Ser Val Gln Phe Glu Glu  
 340 345 350  
 Gln Ile Arg Asn Met Tyr Asp Ala Gly Ala Arg Val Phe Leu Glu Phe  
 355 360 365  
 Gly Pro Arg Gln Val Leu Ala Lys Leu Ile Ala Glu Met Phe Pro Ser  
 370 375 380  
 Cys Thr Ala Ile Ser Val Asn Pro Ala Ser Ser Gly Asp Ser Asp Val  
 385 390 395 400  
 Gln Leu Arg Leu Ala Ala Val Lys Phe Ala Val Ser Gly Ala Ala Leu  
 405 410 415  
 Ser Thr Phe Asp Pro Trp Glu Tyr Arg Lys Pro Gln Asp Leu Leu Ile  
 420 425 430  
 Arg Lys Pro Arg Lys Thr Ala Leu Val Leu Ser Ala Ala Thr Tyr Val  
 435 440 445  
 Ser Pro Lys Thr Leu Ala Glu Arg Lys Lys Ala Met Glu Asp Ile Lys  
 450 455 460  
 Leu Val Ser Ile Thr Pro Arg Asp Ser Met Val Ser Ile Gly Lys Ile  
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Arg Leu Asn Lys  
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Ser Ser Val Ser Ser Ala Arg Leu Ala Glu Ala Glu Ala Val Leu  
20 25 30  
agc gtt ctc gca gac aag aca ggc tac gac agc tca atg atc gag atg 144  
Ser Val Leu Ala Asp Lys Thr Gly Tyr Asp Ser Ser Met Ile Glu Met  
35 40 45  
gac atg gac ctg gag agt gag ctt ggc gtt gat agc atc aaa cgc gtg 192  
Asp Met Asp Leu Glu Ser Glu Leu Gly Val Asp Ser Ile Lys Arg Val  
50 55 60  
gag atc atg agc gag gtt caa acg ctg ctc agc gtg gaa gtc tcc gac 240  
Glu Ile Met Ser Glu Val Gln Thr Leu Leu Ser Val Glu Val Ser Asp  
65 70 75 80  
gtt gac gct ctg tca aga acc aag act gtt ggc gac gtc atc gag gcg 288  
Val Asp Ala Leu Ser Arg Thr Lys Thr Val Gly Asp Val Ile Glu Ala  
85 90 95  
atg aag ctg gaa ctc ggt gga ccc caa ggc cag act ttg acc gcg gaa 336  
Met Lys Leu Glu Leu Gly Gly Pro Gln Gly Gln Thr Leu Thr Ala Glu  
100 105 110  
tcg atc cgt cag cca 351  
Ser Ile Arg Gln Pro  
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Ser Val Leu Ala Asp Lys Thr Gly Tyr Asp Ser Ser Met Ile Glu Met  
35 40 45  
Asp Met Asp Leu Glu Ser Glu Leu Gly Val Asp Ser Ile Lys Arg Val

50

55

60

Glu Ile Met Ser Glu Val Gln Thr Leu Leu Ser Val Glu Val Ser Asp  
65 70 75 80

Val Asp Ala Leu Ser Arg Thr Lys Thr Val Gly Asp Val Ile Glu Ala  
85 90 95

Met Lys Leu Glu Leu Gly Gly Pro Gln Gly Gln Thr Leu Thr Ala Glu  
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Ser Ile Arg Gln Pro  
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<213> Thraustochytrium sp.

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<400> 46

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<220>  
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agt tcg gtt tcg tca gca cgc ctc gct gaa gct gaa gcc gcg gta ctg 96  
Ser Ser Val Ser Ser Ala Arg Leu Ala Glu Ala Glu Ala Ala Val Leu  
20 25 30

agc gtt ctc gca gac aag aca ggc tac gac agc tca atg atc gag atg 144  
Ser Val Leu Ala Asp Lys Thr Gly Tyr Asp Ser Ser Met Ile Glu Met  
35 40 45

gac atg gac ctg gag agt gag ctt ggc gtt gat agc atc aaa cgc gtg 192  
Asp Met Asp Leu Glu Ser Glu Leu Gly Val Asp Ser Ile Lys Arg Val  
50 55 60

gag atc atg agc gag gtt caa acg ctg ctc agc gtg gaa gtc tcc gac 240  
Glu Ile Met Ser Glu Val Gln Thr Leu Leu Ser Val Glu Val Ser Asp  
65 70 75 80

ggt gac gct ctg tca aga acc aag act gtt ggc gac gtc atc gag gcg 288

Val	Asp	Ala	Leu	Ser	Arg	Thr	Lys	Thr	Val	Gly	Asp	Val	Ile	Glu	Ala		
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Met	Lys	Leu	Glu	Leu	Gly	Gly	Pro	Gln	Gly	Gln	Thr	Leu	Thr	Ala	Glu		
			100					105					110				
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Ser	Ile	Arg	Gln	Pro	Pro	Val	Ser	Glu	Pro	Ala	Val	Pro	Thr	Ser	Ser		
		115					120					125					
tca	agc	agt	att	gct	aat	gtt	tcg	tca	gca	cgc	ctc	gct	gaa	gct	gaa	432	
Ser	Ser	Ser	Ile	Ala	Asn	Val	Ser	Ser	Ala	Arg	Leu	Ala	Glu	Ala	Glu		
		130				135					140						
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Ala	Ala	Val	Leu	Ser	Val	Leu	Ala	Asp	Lys	Thr	Gly	Tyr	Asp	Ser	Ser		
145					150					155					160		
atg	atc	gag	atg	gac	atg	gac	ctg	gag	agc	gag	ctt	ggc	gtt	gat	agc	528	
Met	Ile	Glu	Met	Asp	Met	Asp	Leu	Glu	Ser	Glu	Leu	Gly	Val	Asp	Ser		
				165					170					175			
atc	aaa	cgc	gtg	gag	atc	atg	agc	gag	gtt	caa	acg	ctg	ctc	agc	gtg	576	
Ile	Lys	Arg	Val	Glu	Ile	Met	Ser	Glu	Val	Gln	Thr	Leu	Leu	Ser	Val		
			180					185					190				
gaa	gtc	tcc	gac	gtt	gac	gct	ctg	tca	aga	act	aag	act	gtt	ggc	gac	624	
Glu	Val	Ser	Asp	Val	Asp	Ala	Leu	Ser	Arg	Thr	Lys	Thr	Val	Gly	Asp		
		195					200					205					
gtc	atc	gag	gcg	atg	aag	ctg	gaa	ctc	ggg	gga	ccc	caa	ggc	cag	act	672	
Val	Ile	Glu	Ala	Met	Lys	Leu	Glu	Leu	Gly	Gly	Pro	Gln	Gly	Gln	Thr		
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Leu	Thr	Ala	Glu	Ser	Ile	Arg	Gln	Pro	Pro	Val	Ser	Glu	Pro	Ala	Val		
225					230					235					240		
ccg	acc	tca	tcg	tca	agc	agt	att	gct	aat	gtt	tcg	tca	gca	cgc	ctc	768	
Pro	Thr	Ser	Ser	Ser	Ser	Ser	Ile	Ala	Asn	Val	Ser	Ser	Ala	Arg	Leu		
				245					250					255			
gct	gaa	gct	gaa	gcg	gcg	gta	ctg	agc	gtt	ctc	gca	gac	aag	aca	ggc	816	
Ala	Glu	Ala	Glu	Ala	Ala	Val	Leu	Ser	Val	Leu	Ala	Asp	Lys	Thr	Gly		
			260				265						270				
tac	gac	agc	tca	atg	atc	gag	atg	gac	atg	gac	ctg	gag	agc	gag	ctt	864	
Tyr	Asp	Ser	Ser	Met	Ile	Glu	Met	Asp	Met	Asp	Leu	Glu	Ser	Glu	Leu		
		275					280					285					
ggc	gtc	gac	agc	atc	aaa	cgc	gtg	gag	atc	atg	agc	gag	gtt	caa	acg	912	
Gly	Val	Asp	Ser	Ile	Lys	Arg	Val	Glu	Ile	Met	Ser	Glu	Val	Gln	Thr		
	290					295					300						
ctg	ctc	agc	gtg	gaa	gtc	tcc	gac	gtt	gac	gct	ctg	tca	aga	acc	aag	960	
Leu	Leu	Ser	Val	Glu	Val	Ser	Asp	Val	Asp	Ala	Leu	Ser	Arg	Thr	Lys		
305					310					315					320		
act	gtt	ggc	gac	gtc	atc	gag	gcg	atg	aag	ctg	gaa	ctc	ggg	gga	ccc	1008	
Thr	Val	Gly	Asp	Val	Ile	Glu	Ala	Met	Lys	Leu	Glu	Leu	Gly	Gly	Pro		
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caa	ggc	cag	act	ttg	acc	gcg	gaa	tcg	atc	cgt	cag	cca	ccg	gtg	tcc	1056	
Gln	Gly	Gln	Thr	Leu	Thr	Ala	Glu	Ser	Ile	Arg	Gln	Pro	Pro	Val	Ser		
			340					345					350				
gag	cct	gct	gta	ccg	acc	tca	tcg	tca	agc	agt	att	gct	aat	gtt	ttg	1104	

Glu	Pro	Ala	Val	Pro	Thr	Ser	Ser	Ser	Ser	Ser	Ile	Ala	Asn	Val	Leu		
		355					360					365					
tca	gca	cgc	ctc	gct	gaa	gct	gaa	gcc	gcg	gta	ctg	agc	ggt	ctc	gca	1152	
Ser	Ala	Arg	Leu	Ala	Glu	Ala	Glu	Ala	Ala	Val	Leu	Ser	Val	Leu	Ala		
		370				375					380						
gac	aag	aca	ggc	tac	gac	agc	tca	atg	atc	gag	atg	gac	atg	gac	ctg	1200	
Asp	Lys	Thr	Gly	Tyr	Asp	Ser	Ser	Met	Ile	Glu	Met	Asp	Met	Asp	Leu		
					390					395					400		
gag	agc	gag	ctt	ggc	gtt	gat	agc	atc	aaa	cgc	gtg	gag	atc	atg	agc	1248	
Glu	Ser	Glu	Leu	Gly	Val	Asp	Ser	Ile	Lys	Arg	Val	Glu	Ile	Met	Ser		
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gag	gtt	caa	acg	ttg	ctc	agc	gtg	gaa	gtc	tcc	gac	gtt	gac	gct	ctg	1296	
Glu	Val	Gln	Thr	Leu	Leu	Ser	Val	Glu	Val	Ser	Asp	Val	Asp	Ala	Leu		
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Ser	Arg	Thr	Lys	Thr	Val	Gly	Asp	Val	Ile	Glu	Ala	Met	Lys	Leu	Glu		
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ctc	ggt	gga	ccc	caa	ggc	cag	act	ttg	acc	gcg	gaa	tcg	atc	cgt	cag	1392	
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cca	ccg	gtg	tct	gag	cct	gct	gta	ccg	acc	tca	tcg	tca	agc	agt	att	1440	
Pro	Pro	Val	Ser	Glu	Pro	Ala	Val	Pro	Thr	Ser	Ser	Ser	Ser	Ser	Ile		
					470				475						480		
gct	aat	gtt	tcg	tca	gca	cgc	ctc	gct	gaa	gct	gaa	gcc	gcg	gta	ctg	1488	
Ala	Asn	Val	Ser	Ser	Ala	Arg	Leu	Ala	Glu	Ala	Glu	Ala	Ala	Val	Leu		
				485					490					495			
agc	gtt	ctc	gca	gac	aag	aca	ggc	tac	gac	agc	tca	atg	atc	gag	atg	1536	
Ser	Val	Leu	Ala	Asp	Lys	Thr	Gly	Tyr	Asp	Ser	Ser	Met	Ile	Glu	Met		
			500					505					510				
gac	atg	gac	ctg	gag	agt	gag	ctt	ggc	gtc	gac	agc	atc	aaa	cgc	gtg	1584	
Asp	Met	Asp	Leu	Glu	Ser	Glu	Leu	Gly	Val	Asp	Ser	Ile	Lys	Arg	Val		
		515					520					525					
gag	atc	atg	agc	gag	gtt	caa	acg	ctg	ctc	agc	gtg	gaa	gtc	tcc	gac	1632	
Glu	Ile	Met	Ser	Glu	Val	Gln	Thr	Leu	Leu	Ser	Val	Glu	Val	Ser	Asp		
		530				535					540						
gtt	gac	gct	ctg	tca	aga	acc	aag	act	gtt	ggc	gac	gtc	atc	gag	gcg	1680	
Val	Asp	Ala	Leu	Ser	Arg	Thr	Lys	Thr	Val	Gly	Asp	Val	Ile	Glu	Ala		
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atg	aag	ctg	gaa	ctc	ggc	gga	ccc	caa	ggc	cag	act	ttg	acc	tct	gaa	1728	
Met	Lys	Leu	Glu	Leu	Gly	Gly	Pro	Gln	Gly	Gln	Thr	Leu	Thr	Ser	Glu		
				565					570					575			
ccg	atc	cat	cag	cca	cca	gtg	tcc	gag	cct	gct	gta	ccg	acc	tca	tcg	1776	
Pro	Ile	His	Gln	Pro	Pro	Val	Ser	Glu	Pro	Ala	Val	Pro	Thr	Ser	Ser		
			580					585					590				
tca	agc	agt	att	gct	aat	gtt	tct	tca	gca	cgc	ctc	gct	gaa	gct	gaa	1824	
Ser	Ser	Ser	Ile	Ala	Asn	Val	Ser	Ser	Ala	Arg	Leu	Ala	Glu	Ala	Glu		
		595					600					605					
gcc	gcg	gta	ctg	agc	gtt	ctc	gca	gac	aag	aca	ggc	tac	gac	agc	tca	1872	
Ala	Ala	Val	Leu	Ser	Val	Leu	Ala	Asp	Lys	Thr	Gly	Tyr	Asp	Ser	Ser		
		610				615					620						
atg	atc	gag	atg	gac	atg	gac	ctg	gag	agc	gag	ctt	ggc	gtt	gat	agc	1920	

Met Ile Glu Met Asp Met Asp Leu Glu Ser Glu Leu Gly Val Asp Ser	
625 630 635 640	
atc aaa cgc gtg gaa atc atg agc gag gtt caa acg ctg ctc agc gtg	1968
Ile Lys Arg Val Glu Ile Met Ser Glu Val Gln Thr Leu Leu Ser Val	
645 650 655	
gaa gtc tcc gac gtt gac gct ctg tca aga acc aag act gtt ggc gac	2016
Glu Val Ser Asp Val Asp Ala Leu Ser Arg Thr Lys Thr Val Gly Asp	
660 665 670	
gtc atc gag gcg atg aag atg gaa ctc ggt gga ccc caa ggc cag act	2064
Val Ile Glu Ala Met Lys Met Glu Leu Gly Gly Pro Gln Gly Gln Thr	
675 680 685	
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Leu Thr Ala Glu Ser Ile Arg Gln Pro Pro Val Ser Glu Pro Ala Val	
690 695 700	
ccg acc tca tcg tca agc agt att gct aat gtt tcg tca gca cgc ctc	2160
Pro Thr Ser Ser Ser Ser Ser Ile Ala Asn Val Ser Ser Ala Arg Leu	
705 710 715 720	
gct gaa gct gaa gcg gcg gta ctg agc gtt ctc gca gac aag aca ggc	2208
Ala Glu Ala Glu Ala Ala Val Leu Ser Val Leu Ala Asp Lys Thr Gly	
725 730 735	
tac gac agc tca atg atc gag atg gac atg gac ctg gag agc gag ctt	2256
Tyr Asp Ser Ser Met Ile Glu Met Asp Met Asp Leu Glu Ser Glu Leu	
740 745 750	
ggc gtt gat agc atc aaa cgc gtg gag atc atg agc gag gtt caa gcg	2304
Gly Val Asp Ser Ile Lys Arg Val Glu Ile Met Ser Glu Val Gln Ala	
755 760 765	
ctg ctc agc gtg gaa gtc tcc gac gtt gac gct ctg tca aga acc aag	2352
Leu Leu Ser Val Glu Val Ser Asp Val Asp Ala Leu Ser Arg Thr Lys	
770 775 780	
act gtt ggc gac gtc atc gag gcg atg aag atg gaa ctc ggt gga ccc	2400
Thr Val Gly Asp Val Ile Glu Ala Met Lys Met Glu Leu Gly Gly Pro	
785 790 795 800	
caa ggc cag act ttg acc gca gaa tcg atc cgt gag cca ccg gtg tct	2448
Gln Gly Gln Thr Leu Thr Ala Glu Ser Ile Arg Glu Pro Pro Val Ser	
805 810 815	
gag cct gct gta ccg acc tca tcg tca agt agt atc gct aat gtt tct	2496
Glu Pro Ala Val Pro Thr Ser Ser Ser Ser Ser Ile Ala Asn Val Ser	
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tca gct cgc ctc gct gaa gct gaa gcc gcg gta ctg agc gtt ctc gca	2544
Ser Ala Arg Leu Ala Glu Ala Glu Ala Ala Val Leu Ser Val Leu Ala	
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gac aag aca ggc tac gac agc tca atg atc gag atg gac atg gac ctg	2592
Asp Lys Thr Gly Tyr Asp Ser Ser Met Ile Glu Met Asp Met Asp Leu	
850 855 860	
gag agt gag ctt ggc gtc gac agc atc aaa cgc gtg gag atc atg agc	2640
Glu Ser Glu Leu Gly Val Asp Ser Ile Lys Arg Val Glu Ile Met Ser	
865 870 875 880	
gag gtt caa acg ttg ctc agc gtg gaa gtc tcc gac gtt gac gct ctg	2688
Glu Val Gln Thr Leu Leu Ser Val Glu Val Ser Asp Val Asp Ala Leu	
885 890 895	
tca aga acc aag act gtt ggc gac gtc atc gag gcg atg aag ctg gaa	2736



Ser Arg Thr Lys Thr Val Gly Asp Val Ile Glu Ala Met Lys Leu Glu  
 900 905 910  
 ctt ggg gaa tca tca agt att gag act ctc aat tgt acc gag gtt gag 2784  
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 <212> PRT  
 <213> Thraustochytrium sp.  
  
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 1 5 10 15  
  
 Ser Ser Val Ser Ser Ala Arg Leu Ala Glu Ala Glu Ala Ala Val Leu  
 20 25 30  
  
 Ser Val Leu Ala Asp Lys Thr Gly Tyr Asp Ser Ser Met Ile Glu Met  
 35 40 45  
  
 Asp Met Asp Leu Glu Ser Glu Leu Gly Val Asp Ser Ile Lys Arg Val  
 50 55 60  
  
 Glu Ile Met Ser Glu Val Gln Thr Leu Leu Ser Val Glu Val Ser Asp  
 65 70 75 80  
  
 Val Asp Ala Leu Ser Arg Thr Lys Thr Val Gly Asp Val Ile Glu Ala  
 85 90 95  
  
 Met Lys Leu Glu Leu Gly Gly Pro Gln Gly Gln Thr Leu Thr Ala Glu  
 100 105 110  
  
 Ser Ile Arg Gln Pro Pro Val Ser Glu Pro Ala Val Pro Thr Ser Ser  
 115 120 125  
  
 Ser Ser Ser Ile Ala Asn Val Ser Ser Ala Arg Leu Ala Glu Ala Glu  
 130 135 140  
  
 Ala Ala Val Leu Ser Val Leu Ala Asp Lys Thr Gly Tyr Asp Ser Ser  
 145 150 155 160  
  
 Met Ile Glu Met Asp Met Asp Leu Glu Ser Glu Leu Gly Val Asp Ser  
 165 170 175  
  
 Ile Lys Arg Val Glu Ile Met Ser Glu Val Gln Thr Leu Leu Ser Val  
 180 185 190  
  
 Glu Val Ser Asp Val Asp Ala Leu Ser Arg Thr Lys Thr Val Gly Asp

195	200	205
Val Ile Glu Ala Met Lys Leu Glu Leu Gly Gly Pro Gln Gly Gln Thr 210 215 220		
Leu Thr Ala Glu Ser Ile Arg Gln Pro Pro Val Ser Glu Pro Ala Val 225 230 235 240		
Pro Thr Ser Ser Ser Ser Ser Ile Ala Asn Val Ser Ser Ala Arg Leu 245 250 255		
Ala Glu Ala Glu Ala Ala Val Leu Ser Val Leu Ala Asp Lys Thr Gly 260 265 270		
Tyr Asp Ser Ser Met Ile Glu Met Asp Met Asp Leu Glu Ser Glu Leu 275 280 285		
Gly Val Asp Ser Ile Lys Arg Val Glu Ile Met Ser Glu Val Gln Thr 290 295 300		
Leu Leu Ser Val Glu Val Ser Asp Val Asp Ala Leu Ser Arg Thr Lys 305 310 315 320		
Thr Val Gly Asp Val Ile Glu Ala Met Lys Leu Glu Leu Gly Gly Pro 325 330 335		
Gln Gly Gln Thr Leu Thr Ala Glu Ser Ile Arg Gln Pro Pro Val Ser 340 345 350		
Glu Pro Ala Val Pro Thr Ser Ser Ser Ser Ser Ile Ala Asn Val Leu 355 360 365		
Ser Ala Arg Leu Ala Glu Ala Glu Ala Ala Val Leu Ser Val Leu Ala 370 375 380		
Asp Lys Thr Gly Tyr Asp Ser Ser Met Ile Glu Met Asp Met Asp Leu 385 390 395 400		
Glu Ser Glu Leu Gly Val Asp Ser Ile Lys Arg Val Glu Ile Met Ser 405 410 415		
Glu Val Gln Thr Leu Leu Ser Val Glu Val Ser Asp Val Asp Ala Leu 420 425 430		
Ser Arg Thr Lys Thr Val Gly Asp Val Ile Glu Ala Met Lys Leu Glu 435 440 445		
Leu Gly Gly Pro Gln Gly Gln Thr Leu Thr Ala Glu Ser Ile Arg Gln 450 455 460		
Pro Pro Val Ser Glu Pro Ala Val Pro Thr Ser Ser Ser Ser Ile		

465                      470                      475                      480  
 Ala Asn Val Ser Ser Ala Arg Leu Ala Glu Ala Glu Ala Ala Val Leu  
                                  485                                   490                                   495  
 Ser Val Leu Ala Asp Lys Thr Gly Tyr Asp Ser Ser Met Ile Glu Met  
                                  500                                   505                                   510  
 Asp Met Asp Leu Glu Ser Glu Leu Gly Val Asp Ser Ile Lys Arg Val  
                                  515                                   520                                   525  
 Glu Ile Met Ser Glu Val Gln Thr Leu Leu Ser Val Glu Val Ser Asp  
                                  530                                   535                                   540  
 Val Asp Ala Leu Ser Arg Thr Lys Thr Val Gly Asp Val Ile Glu Ala  
                                  545                                   550                                   555                                   560  
 Met Lys Leu Glu Leu Gly Gly Pro Gln Gly Gln Thr Leu Thr Ser Glu  
    565     570     575  
 Pro Ile His Gln Pro Pro Val Ser Glu Pro Ala Val Pro Thr Ser Ser  
    580     585     590  
 Ser Ser Ser Ile Ala Asn Val Ser Ser Ala Arg Leu Ala Glu Ala Glu  
    595     600     605  
 Ala Ala Val Leu Ser Val Leu Ala Asp Lys Thr Gly Tyr Asp Ser Ser  
    610     615     620  
 Met Ile Glu Met Asp Met Asp Leu Glu Ser Glu Leu Gly Val Asp Ser  
    625     630     635     640  
 Ile Lys Arg Val Glu Ile Met Ser Glu Val Gln Thr Leu Leu Ser Val  
    645     650     655  
 Glu Val Ser Asp Val Asp Ala Leu Ser Arg Thr Lys Thr Val Gly Asp  
    660     665     670  
 Val Ile Glu Ala Met Lys Met Glu Leu Gly Gly Pro Gln Gly Gln Thr  
    675     680     685  
 Leu Thr Ala Glu Ser Ile Arg Gln Pro Pro Val Ser Glu Pro Ala Val  
    690     695     700  
 Pro Thr Ser Ser Ser Ser Ser Ile Ala Asn Val Ser Ser Ala Arg Leu  
    705     710     715     720  
 Ala Glu Ala Glu Ala Ala Val Leu Ser Val Leu Ala Asp Lys Thr Gly  
    725     730     735  
 Tyr Asp Ser Ser Met Ile Glu Met Asp Met Asp Leu Glu Ser Glu Leu

740                      745                      750  
 Gly Val Asp Ser Ile Lys Arg Val Glu Ile Met Ser Glu Val Gln Ala  
           755                      760                      765  
 Leu Leu Ser Val Glu Val Ser Asp Val Asp Ala Leu Ser Arg Thr Lys  
           770                      775                      780  
 Thr Val Gly Asp Val Ile Glu Ala Met Lys Met Glu Leu Gly Gly Pro  
           785                      790                      795                      800  
 Gln Gly Gln Thr Leu Thr Ala Glu Ser Ile Arg Glu Pro Pro Val Ser  
                           805                      810                      815  
 Glu Pro Ala Val Pro Thr Ser Ser Ser Ser Ser Ile Ala Asn Val Ser  
                           820                      825                      830  
 Ser Ala Arg Leu Ala Glu Ala Glu Ala Ala Val Leu Ser Val Leu Ala  
                           835                      840                      845  
 Asp Lys Thr Gly Tyr Asp Ser Ser Met Ile Glu Met Asp Met Asp Leu  
           850                      855                      860  
 Glu Ser Glu Leu Gly Val Asp Ser Ile Lys Arg Val Glu Ile Met Ser  
           865                      870                      875                      880  
 Glu Val Gln Thr Leu Leu Ser Val Glu Val Ser Asp Val Asp Ala Leu  
                           885                      890                      895  
 Ser Arg Thr Lys Thr Val Gly Asp Val Ile Glu Ala Met Lys Leu Glu  
                           900                      905                      910  
 Leu Gly Glu Ser Ser Ser Ile Glu Thr Leu Asn Cys Thr Glu Val Glu  
           915                      920                      925

His Thr  
930

<210> 49  
 <211> 2433  
 <212> DNA  
 <213> Thraustochytrium sp.

<220>  
 <221> CDS  
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<400> 49  
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 Lys Ser Val Lys Ala Ser Gly Cys Glu Asn Val Asp Thr Arg Phe Ala  
 1                      5                      10                      15  
 aag gtt gta caa atc tcg ctt cct agc aag ctg aaa tcc act gtg tcg                      96  
 Lys Val Val Gln Ile Ser Leu Pro Ser Lys Leu Lys Ser Thr Val Ser

20	25	30	
cac gat cga cct gta att gtt gta gat gat gga acg ccc tta acc acg His Asp Arg Pro Val Ile Val Val Asp Asp Gly Thr Pro Leu Thr Thr 35 40 45			144
gag ctt tgt aaa att ctt ggg ggt aat att gtg gtt ctc tct tat caa Glu Leu Cys Lys Ile Leu Gly Gly Asn Ile Val Val Leu Ser Tyr Gln 50 55 60			192
ggg aag ccc gct ggt cca cgg gga gtc gag gtg cca gat ctt tcc gag Gly Lys Pro Ala Gly Pro Arg Gly Val Glu Val Pro Asp Leu Ser Glu 65 70 75 80			240
gaa gcc cta att caa gct ctt gca ttg att cgg tct aca tat gga gtt Glu Ala Leu Ile Gln Ala Leu Ala Leu Ile Arg Ser Thr Tyr Gly Val 85 90 95			288
cca att ggt ttt att tgt cag caa gtg tct aat gtg agc acc aag gca Pro Ile Gly Phe Ile Cys Gln Gln Val Ser Asn Val Ser Thr Lys Ala 100 105 110			336
cag ctt tgt tgg gca ctc ctc gca gcg aag cat ctc aag aag gat ttg Gln Leu Cys Trp Ala Leu Leu Ala Ala Lys His Leu Lys Lys Asp Leu 115 120 125			384
aat gct gtc tta ccc gat tca aga tcc ttc ttc gtc gga gtt gta cgc Asn Ala Val Leu Pro Asp Ser Arg Ser Phe Phe Val Gly Val Val Arg 130 135 140			432
ttg aac ggg aaa ctt gga act ttc gaa aac atc agc gac ttc tct aaa Leu Asn Gly Lys Leu Thr Phe Glu Asn Ile Ser Asp Phe Ser Lys 145 150 155 160			480
ttt gat ttg acg aaa gcc cta gat tac gga cag cgt ggt tct ctc tta Phe Asp Leu Thr Lys Ala Leu Asp Tyr Gly Gln Arg Gly Ser Leu Leu 165 170 175			528
ggc ctg tgc aag tca cta gac tta gaa tgg gaa cag gtg ttt tgc cgt Gly Leu Cys Lys Ser Leu Asp Leu Glu Trp Glu Gln Val Phe Cys Arg 180 185 190			576
gga ata gat ctt gcg tgt gat ctt atg cca ctc cag gcc gca agg ata Gly Ile Asp Leu Ala Cys Asp Leu Met Pro Leu Gln Ala Ala Arg Ile 195 200 205			624
ctc aga aat gag ctt cag tgt ccc aat atg cgc ctt cgc gag gtt ggg Leu Arg Asn Glu Leu Gln Cys Pro Asn Met Arg Leu Arg Glu Val Gly 210 215 220			672
tac gat att tct ggc gcc agg tac acc att tca acc gat gac ctg cta Tyr Asp Ile Ser Gly Ala Arg Tyr Thr Ile Ser Thr Asp Asp Leu Leu 225 230 235 240			720
tgt gga ccc tcg aag gct aaa gta gag gcc gca gac ttg ttt ctt gtg Cys Gly Pro Ser Lys Ala Lys Val Glu Ala Ala Asp Leu Phe Leu Val 245 250 255			768
aca ggt ggc gca cga ggt att aca cct cat tgt gtt cgt gag att gca Thr Gly Gly Ala Arg Gly Ile Thr Pro His Cys Val Arg Glu Ile Ala 260 265 270			816
agt cga tcc ccc gga acc aca ttt gtg ctg gtt gga aga agc gaa atg Ser Arg Ser Pro Gly Thr Thr Phe Val Leu Val Gly Arg Ser Glu Met 275 280 285			864
tcc gac gag cct gac tgg gct gtt ggc cac tac aat aaa gac ctg gac Ser Asp Glu Pro Asp Trp Ala Val Gly His Tyr Asn Lys Asp Leu Asp 290 295 300			912

290	295	300	
caa agc aca atg aaa cac ttg aaa gca acg cat gct gct gga ggg gta Gln Ser Thr Met Lys His Leu Lys Ala Thr His Ala Ala Gly Gly Val 305 310 315 320			960
aaa cct acg cct aaa gca cat cgt gca ctt gtg aac agg gtc act ggc Lys Pro Thr Pro Lys Ala His Arg Ala Leu Val Asn Arg Val Thr Gly 325 330 335			1008
tca cgg gag gta cga gaa tct ctt aga gca atc cag gag gca ggg gca Ser Arg Glu Val Arg Glu Ser Leu Arg Ala Ile Gln Glu Ala Gly Ala 340 345 350			1056
aat gtc gaa tat atc gcc tgt gat gtt tcg gat gaa aac aag gtc cgc Asn Val Glu Tyr Ile Ala Cys Asp Val Ser Asp Glu Asn Lys Val Arg 355 360 365			1104
caa ctt gtg caa aga gtg gag caa aag tat ggc tgt gaa ata act ggg Gln Leu Val Gln Arg Val Glu Gln Lys Tyr Gly Cys Glu Ile Thr Gly 370 375 380			1152
att tgg cat gca agc ggg gtt ctt cgt gac aaa ctt gtc gag caa aag Ile Trp His Ala Ser Gly Val Leu Arg Asp Lys Leu Val Glu Gln Lys 385 390 395 400			1200
act aca gac gac ttt gag gca gtt ttt ggg acc aag gtg act ggc ctt Thr Thr Asp Asp Phe Glu Ala Val Phe Gly Thr Lys Val Thr Gly Leu 405 410 415			1248
gta aac atc gtg tca caa gtc aat atg tct aag cta cga cac ttc atc Val Asn Ile Val Ser Gln Val Asn Met Ser Lys Leu Arg His Phe Ile 420 425 430			1296
ctc ttc agt tct ttg gct gga ttt cat ggg aac aag ggc caa acg gat Leu Phe Ser Ser Leu Ala Gly Phe His Gly Asn Lys Gly Gln Thr Asp 435 440 445			1344
tat gca att gct aat gaa gcc ttg aac aaa atc gcg cat act ctc tca Tyr Ala Ile Ala Asn Glu Ala Leu Asn Lys Ile Ala His Thr Leu Ser 450 455 460			1392
gcg ttt ttg ccc aaa ctg aat gca aag gtg cta gac ttc ggt ccg tgg Ala Phe Leu Pro Lys Leu Asn Ala Lys Val Leu Asp Phe Gly Pro Trp 465 470 475 480			1440
gta ggt tca gga atg gta acc gaa aca ctt gag aag cat ttt aaa gct Val Gly Ser Gly Met Val Thr Glu Thr Leu Glu Lys His Phe Lys Ala 485 490 495			1488
atg ggg gtt cag act att cct ctc gag cca gga gca cgg act gtt gcg Met Gly Val Gln Thr Ile Pro Leu Glu Pro Gly Ala Arg Thr Val Ala 500 505 510			1536
caa atc att ttg gca agt tcg cca ccg caa tcg ctt ttg ggg aac tgg Gln Ile Ile Leu Ala Ser Ser Pro Pro Gln Ser Leu Leu Gly Asn Trp 515 520 525			1584
ggc ttt cca gcc acc aaa ccg cta caa cgc tct aat gta gtc acg ggc Gly Phe Pro Ala Thr Lys Pro Leu Gln Arg Ser Asn Val Val Thr Gly 530 535 540			1632
aca ctc tct ccg gaa gag ata gaa ttc atc gca gac cac aaa att caa Thr Leu Ser Pro Glu Glu Ile Glu Phe Ile Ala Asp His Lys Ile Gln 545 550 555 560			1680
ggc cgc aag gtg ctt ccc atg atg gct gca atc ggg ttc atg gcc tct Gly Arg Lys Val Leu Pro Met Met Ala Ala Ile Gly Phe Met Ala Ser 565 570 575 580			1728

565	570	575	
att gcg gaa gga ctc tac ccg ggg tac aat ctg caa ggc gtg gaa aat Ile Ala Glu Gly Leu Tyr Pro Gly Tyr Asn Leu Gln Gly Val Glu Asn 580 585 590			1776
gct cag ctc ttt caa ggc ttg act atc aac caa gag aca aaa ttt caa Ala Gln Leu Phe Gln Gly Leu Thr Ile Asn Gln Glu Thr Lys Phe Gln 595 600 605			1824
atc act ctc att gag gag cac aac tct gag gaa aac ctg gat gtc ctg Ile Thr Leu Ile Glu Glu His Asn Ser Glu Glu Asn Leu Asp Val Leu 610 615 620			1872
aca tcc ctt ggt gta atg ttg gaa agc ggg aag gtg ctt ccc gct tac Thr Ser Leu Gly Val Met Leu Glu Ser Gly Lys Val Leu Pro Ala Tyr 625 630 635 640			1920
cga tgt gtt gta tgc ttg aat aca acc cag cag cag ccc aag cta tct Arg Cys Val Val Cys Leu Asn Thr Thr Gln Gln Gln Pro Lys Leu Ser 645 650 655			1968
cca aaa att ctt aac ttg gaa gtt gac cct gca tgc gag gtt aac ccc Pro Lys Ile Leu Asn Leu Glu Val Asp Pro Ala Cys Glu Val Asn Pro 660 665 670			2016
tat gat gga aag tcg ttg ttc cac ggt ccg ctt ttg caa ttc gtt caa Tyr Asp Gly Lys Ser Leu Phe His Gly Pro Leu Leu Gln Phe Val Gln 675 680 685			2064
caa gtg ttg cac tca agt acc aaa ggc ctc gtt gcc aag tgc cgc gcg Gln Val Leu His Ser Ser Thr Lys Gly Leu Val Ala Lys Cys Arg Ala 690 695 700			2112
ctt cca atc aaa gaa gcc atc cga ggg cca ttt atc aag caa aca ctc Leu Pro Ile Lys Glu Ala Ile Arg Gly Pro Phe Ile Lys Gln Thr Leu 705 710 715 720			2160
cat gat cca att cta gac gac gtc att ttt cag cta atg ctg gtg tgg His Asp Pro Ile Leu Asp Asp Val Ile Phe Gln Leu Met Leu Val Trp 725 730 735			2208
tgt cgt aat gct cta gga agt gca tcg cta ccc aac aga att gaa aag Cys Arg Asn Ala Leu Gly Ser Ala Ser Leu Pro Asn Arg Ile Glu Lys 740 745 750			2256
atg tca tac ttt ggg aat gtc tca gaa ggt agc act ttc ttt gcc tca Met Ser Tyr Phe Gly Asn Val Ser Glu Gly Ser Thr Phe Phe Ala Ser 755 760 765			2304
gtt aca cct gtg gga cca aga gta cca aag gat ccc gtg atc aaa atg Val Thr Pro Val Gly Pro Arg Val Pro Lys Asp Pro Val Ile Lys Met 770 775 780			2352
cag ttt ctt ctc caa gat gaa tcc ggc aac aca ttt tca tcg ggg gag Gln Phe Leu Leu Gln Asp Glu Ser Gly Asn Thr Phe Ser Ser Gly Glu 785 790 795 800			2400
ggc tcg gtt gtg ctt agt gac gaa ctc gtc ttt Gly Ser Val Val Leu Ser Asp Glu Leu Val Phe 805 810			2433

<210> 50  
 <211> 811  
 <212> PRT  
 <213> Thraustochytrium sp.

<400> 50

Lys Ser Val Lys Ala Ser Gly Cys Glu Asn Val Asp Thr Arg Phe Ala  
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Lys Val Val Gln Ile Ser Leu Pro Ser Lys Leu Lys Ser Thr Val Ser  
20 25 30

His Asp Arg Pro Val Ile Val Val Asp Asp Gly Thr Pro Leu Thr Thr  
35 40 45

Glu Leu Cys Lys Ile Leu Gly Gly Asn Ile Val Val Leu Ser Tyr Gln  
50 55 60

Gly Lys Pro Ala Gly Pro Arg Gly Val Glu Val Pro Asp Leu Ser Glu  
65 70 75 80

Glu Ala Leu Ile Gln Ala Leu Ala Leu Ile Arg Ser Thr Tyr Gly Val  
85 90 95

Pro Ile Gly Phe Ile Cys Gln Gln Val Ser Asn Val Ser Thr Lys Ala  
100 105 110

Gln Leu Cys Trp Ala Leu Leu Ala Ala Lys His Leu Lys Lys Asp Leu  
115 120 125

Asn Ala Val Leu Pro Asp Ser Arg Ser Phe Phe Val Gly Val Val Arg  
130 135 140

Leu Asn Gly Lys Leu Gly Thr Phe Glu Asn Ile Ser Asp Phe Ser Lys  
145 150 155 160

Phe Asp Leu Thr Lys Ala Leu Asp Tyr Gly Gln Arg Gly Ser Leu Leu  
165 170 175

Gly Leu Cys Lys Ser Leu Asp Leu Glu Trp Glu Gln Val Phe Cys Arg  
180 185 190

Gly Ile Asp Leu Ala Cys Asp Leu Met Pro Leu Gln Ala Ala Arg Ile  
195 200 205

Leu Arg Asn Glu Leu Gln Cys Pro Asn Met Arg Leu Arg Glu Val Gly  
210 215 220

Tyr Asp Ile Ser Gly Ala Arg Tyr Thr Ile Ser Thr Asp Asp Leu Leu  
225 230 235 240

Cys Gly Pro Ser Lys Ala Lys Val Glu Ala Ala Asp Leu Phe Leu Val  
245 250 255

Thr Gly Gly Ala Arg Gly Ile Thr Pro His Cys Val Arg Glu Ile Ala  
260 265 270



Ser Arg Ser Pro Gly Thr Thr Phe Val Leu Val Gly Arg Ser Glu Met  
 275 280 285

Ser Asp Glu Pro Asp Trp Ala Val Gly His Tyr Asn Lys Asp Leu Asp  
 290 295 300

Gln Ser Thr Met Lys His Leu Lys Ala Thr His Ala Ala Gly Gly Val  
 305 310 315 320

Lys Pro Thr Pro Lys Ala His Arg Ala Leu Val Asn Arg Val Thr Gly  
 325 330 335

Ser Arg Glu Val Arg Glu Ser Leu Arg Ala Ile Gln Glu Ala Gly Ala  
 340 345 350

Asn Val Glu Tyr Ile Ala Cys Asp Val Ser Asp Glu Asn Lys Val Arg  
 355 360 365

Gln Leu Val Gln Arg Val Glu Gln Lys Tyr Gly Cys Glu Ile Thr Gly  
 370 375 380

Ile Trp His Ala Ser Gly Val Leu Arg Asp Lys Leu Val Glu Gln Lys  
 385 390 395 400

Thr Thr Asp Asp Phe Glu Ala Val Phe Gly Thr Lys Val Thr Gly Leu  
 405 410 415

Val Asn Ile Val Ser Gln Val Asn Met Ser Lys Leu Arg His Phe Ile  
 420 425 430

Leu Phe Ser Ser Leu Ala Gly Phe His Gly Asn Lys Gly Gln Thr Asp  
 435 440 445

Tyr Ala Ile Ala Asn Glu Ala Leu Asn Lys Ile Ala His Thr Leu Ser  
 450 455 460

Ala Phe Leu Pro Lys Leu Asn Ala Lys Val Leu Asp Phe Gly Pro Trp  
 465 470 475 480

Val Gly Ser Gly Met Val Thr Glu Thr Leu Glu Lys His Phe Lys Ala  
 485 490 495

Met Gly Val Gln Thr Ile Pro Leu Glu Pro Gly Ala Arg Thr Val Ala  
 500 505 510

Gln Ile Ile Leu Ala Ser Ser Pro Pro Gln Ser Leu Leu Gly Asn Trp  
 515 520 525

Gly Phe Pro Ala Thr Lys Pro Leu Gln Arg Ser Asn Val Val Thr Gly  
 530 535 540

Thr Leu Ser Pro Glu Glu Ile Glu Phe Ile Ala Asp His Lys Ile Gln  
 545 550 555 560

Gly Arg Lys Val Leu Pro Met Met Ala Ala Ile Gly Phe Met Ala Ser  
 565 570 575

Ile Ala Glu Gly Leu Tyr Pro Gly Tyr Asn Leu Gln Gly Val Glu Asn  
 580 585 590

Ala Gln Leu Phe Gln Gly Leu Thr Ile Asn Gln Glu Thr Lys Phe Gln  
 595 600 605

Ile Thr Leu Ile Glu Glu His Asn Ser Glu Glu Asn Leu Asp Val Leu  
 610 615 620

Thr Ser Leu Gly Val Met Leu Glu Ser Gly Lys Val Leu Pro Ala Tyr  
 625 630 635 640

Arg Cys Val Val Cys Leu Asn Thr Thr Gln Gln Gln Pro Lys Leu Ser  
 645 650 655

Pro Lys Ile Leu Asn Leu Glu Val Asp Pro Ala Cys Glu Val Asn Pro  
 660 665 670

Tyr Asp Gly Lys Ser Leu Phe His Gly Pro Leu Leu Gln Phe Val Gln  
 675 680 685

Gln Val Leu His Ser Ser Thr Lys Gly Leu Val Ala Lys Cys Arg Ala  
 690 695 700

Leu Pro Ile Lys Glu Ala Ile Arg Gly Pro Phe Ile Lys Gln Thr Leu  
 705 710 715 720

His Asp Pro Ile Leu Asp Asp Val Ile Phe Gln Leu Met Leu Val Trp  
 725 730 735

Cys Arg Asn Ala Leu Gly Ser Ala Ser Leu Pro Asn Arg Ile Glu Lys  
 740 745 750

Met Ser Tyr Phe Gly Asn Val Ser Glu Gly Ser Thr Phe Phe Ala Ser  
 755 760 765

Val Thr Pro Val Gly Pro Arg Val Pro Lys Asp Pro Val Ile Lys Met  
 770 775 780

Gln Phe Leu Leu Gln Asp Glu Ser Gly Asn Thr Phe Ser Ser Gly Glu  
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Gly Ser Val Val Leu Ser Asp Glu Leu Val Phe  
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 <213> Thraustochytrium sp.

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<220>  
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 <222> (1)..(5808)  
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 gtg ggc atg gcc gtc aaa tat gcg ggc tgt gac aat aaa gaa gag ttt 96  
 Val Gly Met Ala Val Lys Tyr Ala Gly Cys Asp Asn Lys Glu Glu Phe  
 20 25 30  
 tgg aag act ttg atg aat ggt agt atc aat acc aag tcg att tcg gca 144  
 Trp Lys Thr Leu Met Asn Gly Ser Ile Asn Thr Lys Ser Ile Ser Ala  
 35 40 45  
 gca agg ttg ggc agc aat aag cgt gac gaa cac tat gtt cct gaa cga 192  
 Ala Arg Leu Gly Ser Asn Lys Arg Asp Glu His Tyr Val Pro Glu Arg  
 50 55 60  
 tcg aaa tat gca gat acg ttc tgt aac gaa agg tac ggt tgt atc cag 240  
 Ser Lys Tyr Ala Asp Thr Phe Cys Asn Glu Arg Tyr Gly Cys Ile Gln  
 65 70 75 80  
 caa ggt acg gat aat gag cat gac ctc ctc cta ggt ctt gct caa gaa 288  
 Gln Gly Thr Asp Asn Glu His Asp Leu Leu Leu Gly Leu Ala Gln Glu  
 85 90 95  
 gct ctc gct gac gct gcc ggg cgg atg gag aaa caa cct tcg gag gcg 336  
 Ala Leu Ala Asp Ala Ala Gly Arg Met Glu Lys Gln Pro Ser Glu Ala  
 100 105 110  
 ttc gat ctg gaa aat act ggc atc gtg agt ggg tgc tta tct ttt cca 384  
 Phe Asp Leu Glu Asn Thr Gly Ile Val Ser Gly Cys Leu Ser Phe Pro  
 115 120 125  
 atg gat aac ctg caa gga gag ttg ttg aac ttg tat caa agc cat gtg 432  
 Met Asp Asn Leu Gln Gly Glu Leu Leu Asn Leu Tyr Gln Ser His Val  
 130 135 140  
 gag aaa caa ctt cca cct agt gcc ttg gta gaa gcc gtg aag ctt tgg 480  
 Glu Lys Gln Leu Pro Pro Ser Ala Leu Val Glu Ala Val Lys Leu Trp  
 145 150 155 160  
 tct gag cga cag aaa tct acg aaa gca cat gca ggg gac aag cgc cgg 528  
 Ser Glu Arg Gln Lys Ser Thr Lys Ala His Ala Gly Asp Lys Arg Arg  
 165 170 175  
 ttc att gac cca gct tct ttt gta gct gat aaa ctg aac cta ggc cca 576  
 Phe Ile Asp Pro Ala Ser Phe Val Ala Asp Lys Leu Asn Leu Gly Pro  
 180 185 190  
 cta cat tat gcg atc gat gca gca tgc gct tct gca ttg tac gtg tta 624  
 Leu His Tyr Ala Ile Asp Ala Ala Cys Ala Ser Ala Leu Tyr Val Leu  
 195 200 205

aaa tta gct caa gac cac ctt gtt tca ggt gcc gtt gat atg atg tta Lys Leu Ala Gln Asp His Leu Val Ser Gly Ala Val Asp Met Met Leu 210 215 220	672
tgt gga gcg acg tgc ttc cca gaa cca ttc ttc atc ttg tct ggg ttc Cys Gly Ala Thr Cys Phe Pro Glu Pro Phe Phe Ile Leu Ser Gly Phe 225 230 235 240	720
tcg act ttt caa gcg atg cct gnt ggg gca gat gga gtc tca cta cct Ser Thr Phe Gln Ala Met Pro Xaa Gly Ala Asp Gly Val Ser Leu Pro 245 250 255	768
ctc cat aaa acg agt gct ggg ctc act cca ggt gaa ggg ggg tcc att Leu His Lys Thr Ser Ala Gly Leu Thr Pro Gly Glu Gly Gly Ser Ile 260 265 270	816
atg gtg ctc aag cga ctg aaa gac gct atc aga gat gga aat cac att Met Val Leu Lys Arg Leu Lys Asp Ala Ile Arg Asp Gly Asn His Ile 275 280 285	864
tat ggt gtg ctc ctt gaa gca aat tta agt aac gca ggt tgt ggg ctt Tyr Gly Val Leu Leu Glu Ala Asn Leu Ser Asn Ala Gly Cys Gly Leu 290 295 300	912
cca ctc agc ccg cac tta ccg agc gaa gaa tca tgt att cgt gat acc Pro Leu Ser Pro His Leu Pro Ser Glu Glu Ser Cys Ile Arg Asp Thr 305 310 315 320	960
tac cgc cgt gct gga gtt gct gca gat caa agt att cag tat att gag Tyr Arg Arg Ala Gly Val Ala Ala Asp Gln Ser Ile Gln Tyr Ile Glu 325 330 335	1008
tgc cac gct acg gga acc cct cga ggg gat gtc gtg gaa att gag gcg Cys His Ala Thr Gly Thr Pro Arg Gly Asp Val Val Glu Ile Glu Ala 340 345 350	1056
gtt gaa aga gtt ttc aag aaa aac gtt cca cgc tta ggc tcg acg aaa Val Glu Arg Val Phe Lys Lys Asn Val Pro Arg Leu Gly Ser Thr Lys 355 360 365	1104
gga aat ttt ggt cac tcg tta gtt gcg gct ggt ttc gca ggt atg gca Gly Asn Phe Gly His Ser Leu Val Ala Ala Gly Phe Ala Gly Met Ala 370 375 380	1152
aag ctt ctt ctt gca atg gaa cat gga gtg att cct ccc aca cca ggt Lys Leu Leu Leu Ala Met Glu His Gly Val Ile Pro Pro Thr Pro Gly 385 390 395 400	1200
ctt gat gct tcg aac cag gca agt gag cac gtt gtg aca aag gct atc Leu Asp Ala Ser Asn Gln Ala Ser Glu His Val Val Thr Lys Ala Ile 405 410 415	1248
act tgg cct gag aca cat ggg gct cca aaa cga gct ggc ctt tca gca Thr Trp Pro Glu Thr His Gly Ala Pro Lys Arg Ala Gly Leu Ser Ala 420 425 430	1296
ttt gga ttt ggt ggg act aat gcg cat gca ctc ttc gaa gag ttt aat Phe Gly Phe Gly Gly Thr Asn Ala His Ala Leu Phe Glu Glu Phe Asn 435 440 445	1344
gcc gag ggc ata agt tat cgc cct gga aag cct cca gtc gaa tcg aat Ala Glu Gly Ile Ser Tyr Arg Pro Gly Lys Pro Val Glu Ser Asn 450 455 460	1392
acc cgt cct tcc gtc gta ata act ggg atg gac tgt acc ttt ggg agc Thr Arg Pro Ser Val Val Ile Thr Gly Met Asp Cys Thr Phe Gly Ser 465 470 475 480	1440

ctt gaa ggg att gat gcg ttc gag act gcc ctg tac gag ggg cgt gac Leu Glu Gly Ile Asp Ala Phe Glu Thr Ala Leu Tyr Glu Gly Arg Asp 485 490 495	1488
gca gct cgt gac tta ccc gcc aaa cgt tgg agg ttc cta ggt gag gac Ala Ala Arg Asp Leu Pro Ala Lys Arg Trp Arg Phe Leu Gly Glu Asp 500 505 510	1536
ttg gag ttt ctc cga gcc atc agg ctc aag gaa aag cct agg ggt tgt Leu Glu Phe Leu Arg Ala Ile Arg Leu Lys Glu Lys Pro Arg Gly Cys 515 520 525	1584
ttt gtg gag agt gtt gac gtt aac ttt aga cgg ctg aaa acg ccc ttg Phe Val Glu Ser Val Asp Val Asn Phe Arg Arg Leu Lys Thr Pro Leu 530 535 540	1632
aca cca gaa gat atg ttg cgg ccc caa caa ctc ttg gcg gtt tct acg Thr Pro Glu Asp Met Leu Arg Pro Gln Gln Leu Leu Ala Val Ser Thr 545 550 555 560	1680
atg gac cga gca att atc gat gca ggt cta aag aag ggc caa cat gta Met Asp Arg Ala Ile Ile Asp Ala Gly Leu Lys Lys Gly Gln His Val 565 570 575	1728
gca gtt ctt gtt ggc cta gga act gac ctg gaa ctt tac cgt cat cga Ala Val Leu Val Gly Leu Gly Thr Asp Leu Glu Leu Tyr Arg His Arg 580 585 590	1776
gca aga gtc gcg ctt aaa gag gtt ttg cac ccg agc tta aag tca gac Ala Arg Val Ala Leu Lys Glu Val Leu His Pro Ser Leu Lys Ser Asp 595 600 605	1824
act gca att ctc cag aaa ata atg caa tat gtg aat gat gca gga act Thr Ala Ile Leu Gln Lys Ile Met Gln Tyr Val Asn Asp Ala Gly Thr 610 615 620	1872
tcg act tca tac aca tct tac att gga aac ctc gtt gcc acg cgt att Ser Thr Ser Tyr Thr Ser Tyr Ile Gly Asn Leu Val Ala Thr Arg Ile 625 630 635 640	1920
tcg tct cag tgg gga ttc aca ggg ccg tcc ttt act gtc aca gaa gga Ser Ser Gln Trp Gly Phe Thr Gly Pro Ser Phe Thr Val Thr Glu Gly 645 650 655	1968
aat aat tcc gtg tac aga tgt gca caa cta gcc aaa gat atg ctt cag Asn Asn Ser Val Tyr Arg Cys Ala Gln Leu Ala Lys Asp Met Leu Gln 660 665 670	2016
gtt aac cga gtt gat gct gtc gtc atc gca ggc gtt gat ctc aac gga Val Asn Arg Val Asp Ala Val Val Ile Ala Gly Val Asp Leu Asn Gly 675 680 685	2064
agc gcc gaa agt ttt ttt gtc cga gca aat cgt caa aag ata tcc aag Ser Ala Glu Ser Phe Phe Val Arg Ala Asn Arg Gln Lys Ile Ser Lys 690 695 700	2112
cta agt cat cca tgt gca agc ttc gac aga gat gca gat gga ttt ttc Leu Ser His Pro Cys Ala Ser Phe Asp Arg Asp Ala Asp Gly Phe Phe 705 710 715 720	2160
gca ggt gag ggc tgt ggt gcc cta gtt ttc aag agg tta gaa gac tgt Ala Gly Glu Gly Cys Gly Ala Leu Val Phe Lys Arg Leu Glu Asp Cys 725 730 735	2208
gct cct cag gaa aaa att tat gct agt ata gac tct atc gca ata gat Ala Pro Gln Glu Lys Ile Tyr Ala Ser Ile Asp Ser Ile Ala Ile Asp 740 745 750	2256

aaa gag cct act agc tca gct gtg aaa gct gtc tac caa agt gat tcg Lys Glu Pro Thr Ser Ser Ala Val Lys Ala Val Tyr Gln Ser Asp Ser 755 760 765	2304
agt ctc tcc gat att gag ctg tta gaa atc agt gga gac tcc aaa cgg Ser Leu Ser Asp Ile Glu Leu Leu Glu Ile Ser Gly Asp Ser Lys Arg 770 775 780	2352
ttt gca gca ttc gaa ggc gct gtg gaa att caa tca agt gtg gaa gcc Phe Ala Ala Phe Glu Gly Ala Val Glu Ile Gln Ser Ser Val Glu Ala 785 790 795 800	2400
cag cta aaa gga ctt tcc aaa gtc ctt gaa cct gca aaa ggc caa ggc Gln Leu Lys Gly Leu Ser Lys Val Leu Glu Pro Ala Lys Gly Gln Gly 805 810 815	2448
gta gcg gtg gga agt act cga gca acc gtt ggg gat ata ggg tat gct Val Ala Val Gly Ser Thr Arg Ala Thr Val Gly Asp Ile Gly Tyr Ala 820 825 830	2496
aca gga gcg gca agc ctg att aaa act gca ctc tgc tta tat aat cgc Thr Gly Ala Ala Ser Leu Ile Lys Thr Ala Leu Cys Leu Tyr Asn Arg 835 840 845	2544
tac ctt ccg gca tta gca aac tgg agt ggc cca tgt gaa cag tcc gcc Tyr Leu Pro Ala Leu Ala Asn Trp Ser Gly Pro Cys Glu Gln Ser Ala 850 855 860	2592
tgg ggc tca aac atg ttc gtt tgc cat gaa aca cgg ccg tgg atg aaa Trp Gly Ser Asn Met Phe Val Cys His Glu Thr Arg Pro Trp Met Lys 865 870 875 880	2640
aac cag aat gaa aag aga tgt gcc ctc att tct gga aca gat cca tct Asn Gln Asn Glu Lys Arg Cys Ala Leu Ile Ser Gly Thr Asp Pro Ser 885 890 895	2688
cat aca tgc ttt tcc ctc gta cta tcg gat act ggg tgt tat gaa gag His Thr Cys Phe Ser Leu Val Leu Ser Asp Thr Gly Cys Tyr Glu Glu 900 905 910	2736
cac aat cga acg tgc ttt gat gtg caa gcg cca cag cta gtt ctg ata His Asn Arg Thr Cys Phe Asp Val Gln Ala Pro Gln Leu Val Leu Ile 915 920 925	2784
cac gga ttc gat gga aaa act att gtg cgg cga ctt gaa gga tat ctc His Gly Phe Asp Gly Lys Thr Ile Val Arg Arg Leu Glu Gly Tyr Leu 930 935 940	2832
ctt gaa ctt gtt gaa ggg cat gca agc cct tca gag tat ttc cac aaa Leu Glu Leu Val Glu Gly His Ala Ser Pro Ser Glu Tyr Phe His Lys 945 950 955 960	2880
ctg att gga caa agt cta ctt gag aac tcg aaa gaa agt aaa ctc aca Leu Ile Gly Gln Ser Leu Leu Glu Asn Ser Lys Glu Ser Lys Leu Thr 965 970 975	2928
ctt tcg ctt gtg tgc aat ccg aac cag ctc caa aag gag ctc atg ctt Leu Ser Leu Val Cys Asn Pro Asn Gln Leu Gln Lys Glu Leu Met Leu 980 985 990	2976
gct atc aaa gga gta caa cga agc atg tta aca ggg aag gat tgg gtc Ala Ile Lys Gly Val Gln Arg Ser Met Leu Thr Gly Lys Asp Trp Val 995 1000 1005	3024
agt cca tca gga agt tgt ttt gcc cca aat ccg tta tca agc gca Ser Pro Ser Gly Ser Cys Phe Ala Pro Asn Pro Leu Ser Ser Ala 1010 1015 1020	3069

aaa gtg gca ttc atg tac gga gaa ggc cga agc ccg tac tgt ggt Lys Val Ala Phe Met Tyr Gly Glu Gly Arg Ser Pro Tyr Cys Gly 1025 1030 1035	3114
gta ggc ttg ggt cta cat cgt ttg tgg ccc ggt ctc cat gaa aat Val Gly Leu Gly Leu His Arg Leu Trp Pro Gly Leu His Glu Asn 1040 1045 1050	3159
gtg aac aat aag aca gtc gat tta tgg acg gaa gga gat ggt tgg Val Asn Asn Lys Thr Val Asp Leu Trp Thr Glu Gly Asp Gly Trp 1055 1060 1065	3204
tta tat cct cga acg ttg aca cga gaa gag cat aca aaa gcc atc Leu Tyr Pro Arg Thr Leu Thr Arg Glu Glu His Thr Lys Ala Ile 1070 1075 1080	3249
gaa tct ttc aac gca aat caa att gaa atg ttt cgc gct ggg att Glu Ser Phe Asn Ala Asn Gln Ile Glu Met Phe Arg Ala Gly Ile 1085 1090 1095	3294
ttc atc tca atg tgt cag aca gac tat gtc atg aat gtt ctc ggt Phe Ile Ser Met Cys Gln Thr Asp Tyr Val Met Asn Val Leu Gly 1100 1105 1110	3339
gtc cag cct aag gcc gga ttt ggg ctg agc ttg gga gaa att tca Val Gln Pro Lys Ala Gly Phe Gly Leu Ser Leu Gly Glu Ile Ser 1115 1120 1125	3384
atg ctc ttt gcg atg tca aag gag aac tgc agg cag tca cag gaa Met Leu Phe Ala Met Ser Lys Glu Asn Cys Arg Gln Ser Gln Glu 1130 1135 1140	3429
atg acc aat cgt ttg cgc ggt tct cca gtg tgg tct aac gag ctt Met Thr Asn Arg Leu Arg Gly Ser Pro Val Trp Ser Asn Glu Leu 1145 1150 1155	3474
gct atc aac ttc aat gca att cgc aag tta tgg aaa atc ccc cga Ala Ile Asn Phe Asn Ala Ile Arg Lys Leu Trp Lys Ile Pro Arg 1160 1165 1170	3519
gga gct ccc tta gaa tcc ttt tgg caa gga tac ttg gtt cac ggc Gly Ala Pro Leu Glu Ser Phe Trp Gln Gly Tyr Leu Val His Gly 1175 1180 1185	3564
aca aga gaa gaa gta gag cat gct att ggt ctt tct gag cct tat Thr Arg Glu Glu Val Glu His Ala Ile Gly Leu Ser Glu Pro Tyr 1190 1195 1200	3609
gta cgt ctg ctt att gtg aac gat tca agg agt gcc ttg att gct Val Arg Leu Leu Ile Val Asn Asp Ser Arg Ser Ala Leu Ile Ala 1205 1210 1215	3654
gga aaa cca gac gcc tgt cag gca gta atc agt aga cta aac tcc Gly Lys Pro Asp Ala Cys Gln Ala Val Ile Ser Arg Leu Asn Ser 1220 1225 1230	3699
aag ttc cct tct ctg ccg gta aag caa gga atg att ggt cat tgc Lys Phe Pro Ser Leu Pro Val Lys Gln Gly Met Ile Gly His Cys 1235 1240 1245	3744
cca gaa gtt cgt gcg ttc atc aaa gat att ggg tac atc cat gaa Pro Glu Val Arg Ala Phe Ile Lys Asp Ile Gly Tyr Ile His Glu 1250 1255 1260	3789
aca ctc cga att tcc aat gac tat tcg gat tgt cag ctt ttc tca Thr Leu Arg Ile Ser Asn Asp Tyr Ser Asp Cys Gln Leu Phe Ser 1265 1270 1275	3834

gcg gta acc aag ggc gca ctt gac agc tcc aca atg gaa atc aaa Ala Val Thr Lys Gly Ala Leu Asp Ser Ser Thr Met Glu Ile Lys 1280 1285 1290	3879
cac ttt gtg gga gag gtc tac tcc cgg atc gca gac ttt cct caa His Phe Val Gly Glu Val Tyr Ser Arg Ile Ala Asp Phe Pro Gln 1295 1300 1305	3924
atc gtc aac acg gtg cat tcg gct ggt tat gac gta ttt ctt gag Ile Val Asn Thr Val His Ser Ala Gly Tyr Asp Val Phe Leu Glu 1310 1315 1320	3969
ctt ggc tgt gat gct tct aga tct gca gca gtt caa aac att ctt Leu Gly Cys Asp Ala Ser Arg Ser Ala Ala Val Gln Asn Ile Leu 1325 1330 1335	4014
ggg ggt caa gga aag ttc ttg tct aca gct att gac aaa aaa gga Gly Gly Gln Gly Lys Phe Leu Ser Thr Ala Ile Asp Lys Lys Gly 1340 1345 1350	4059
cac tcc gcc tgg tca caa gta ctt cgg gct acc gca tca tta gct His Ser Ala Trp Ser Gln Val Leu Arg Ala Thr Ala Ser Leu Ala 1355 1360 1365	4104
gca cat cga gta ccg gga atc tca att ttg gat ttg ttt cac cca Ala His Arg Val Pro Gly Ile Ser Ile Leu Asp Leu Phe His Pro 1370 1375 1380	4149
aat ttc cga gaa atg tgc tgt aca atg gca acc aca cct aaa gtg Asn Phe Arg Glu Met Cys Cys Thr Met Ala Thr Thr Pro Lys Val 1385 1390 1395	4194
gaa gat aag ttc ctg cgc acg att caa atc aat ggt cgg ttt gaa Glu Asp Lys Phe Leu Arg Thr Ile Gln Ile Asn Gly Arg Phe Glu 1400 1405 1410	4239
aaa gaa atg att cac cta gaa gat aca aca tta agt tgc tta ccc Lys Glu Met Ile His Leu Glu Asp Thr Thr Leu Ser Cys Leu Pro 1415 1420 1425	4284
gct cca agt gaa gca aat atc gca gct att caa tct cgg tca att Ala Pro Ser Glu Ala Asn Ile Ala Ala Ile Gln Ser Arg Ser Ile 1430 1435 1440	4329
cga tct gct gcg gcg cgt tct gga caa tcc cat gat tgt gca tcc Arg Ser Ala Ala Ala Arg Ser Gly Gln Ser His Asp Cys Ala Ser 1445 1450 1455	4374
cat agc cat gaa gaa aat aag gat tca tgc cct gaa aag ctg aag His Ser His Glu Glu Asn Lys Asp Ser Cys Pro Glu Lys Leu Lys 1460 1465 1470	4419
ctt gat tct gtg tcc gtc gcc ata aat ttc gac aat gat gac cgc Leu Asp Ser Val Ser Val Ala Ile Asn Phe Asp Asn Asp Asp Arg 1475 1480 1485	4464
att cag ctt ggg cac gcg ggt ttt cgg gag atg tac aat aca aga Ile Gln Leu Gly His Ala Gly Phe Arg Glu Met Tyr Asn Thr Arg 1490 1495 1500	4509
tat agc ttg tac aca ggg gcg atg gca aag gga att gca tct gca Tyr Ser Leu Tyr Thr Gly Ala Met Ala Lys Gly Ile Ala Ser Ala 1505 1510 1515	4554
gat ctt gtc att gcc gct ggg aaa gag ggc atc cta gct tcc tat Asp Leu Val Ile Ala Ala Gly Lys Glu Gly Ile Leu Ala Ser Tyr 1520 1525 1530	4599



gga gct Gly Ala 1535	gga gga cta cct ctt Gly Gly Leu Pro 1540	gct act gtt cga aag Ala Thr Val Arg Lys 1545	gga ata gac Gly Ile Asp 4644
aaa att Lys Ile 1550	caa caa gcc ttg cca Gln Gln Ala Leu Pro 1555	agt ggc cca tat gct Ser Gly Pro Tyr Ala 1560	gta aat ctt Val Asn Leu 4689
att cac Ile His 1565	tct ccc ttt gac ggc Ser Pro Phe Asp Gly 1570	aac ttg gag cag gga Asn Leu Glu Gln Gly 1575	aac gtc gat Asn Val Asp 4734
ttg ttc Leu Phe 1580	ttg gaa aag aac gtc Leu Glu Lys Asn Val 1585	cgc gtg gcg gaa tgt Arg Val Ala Glu Cys 1590	tcc gcg ttt Ser Ala Phe 4779
aca acg Thr Thr 1595	cta aca gtg cca gta Leu Thr Val Pro Val 1600	gta cac tat cgt gct Val His Tyr Arg Ala 1605	gca ggg ctt Ala Gly Leu 4824
gtt cgg Val Arg 1610	cgc caa gat gga agc Arg Gln Asp Gly Ser 1615	att ttg atc aag aac Ile Leu Ile Lys Asn 1620	cga atc att Arg Ile Ile 4869
gct aaa Ala Lys 1625	gta tct agg aca gaa Val Ser Arg Thr Glu 1630	ctc gct gag atg ttc Leu Ala Glu Met Phe 1635	ctt cgt ccg Leu Arg Pro 4914
gca cct Ala Pro 1640	caa atc atc ctc gaa Gln Ile Ile Leu Glu 1645	aaa ctg gta gca gca Lys Leu Val Ala Ala 1650	gaa atc att Glu Ile Ile 4959
tca tct Ser Ser 1655	gac caa gcg cgt atg Asp Gln Ala Arg Met 1660	gca gcc aaa gtt ccc Ala Ala Lys Val Pro 1665	atg gcg gac Met Ala Asp 5004
gac atc Asp Ile 1670	gca gtc gaa gcc gac Ala Val Glu Ala Asp 1675	tct ggt ggg cac acg Ser Gly Gly His Thr 1680	gat aat cgg Asp Asn Arg 5049
cct atg Pro Met 1685	cac gtc att ttg ccc His Val Ile Leu Pro 1690	ctg ata att caa ctc Leu Ile Ile Gln Leu 1695	cgc aat act Arg Asn Thr 5094
ata ctt Ile Leu 1700	gca gag tat ggc tgt Ala Glu Tyr Gly Cys 1705	gcc acg gct ttt cgt Ala Thr Ala Phe Arg 1710	acc cgt ata Thr Arg Ile 5139
ggc gct Gly Ala 1715	gga gga ggc att ggt Gly Gly Gly Ile Gly 1720	tgt cct tca gcg gcc Cys Pro Ser Ala Ala 1725	ctc gca gcc Leu Ala Ala 5184
ttt gat Phe Asp 1730	atg ggt gcg agt ttt Met Gly Ala Ser Phe 1735	gtc gtg act gga agc Val Val Thr Gly Ser 1740	ata aat caa Ile Asn Gln 5229
att tgc Ile Cys 1745	cgc gag gca ggg act Arg Glu Ala Gly Thr 1750	tgc gat act gtt cgg Cys Asp Thr Val Arg 1755	gag cta ctt Glu Leu Leu 5274
gcc aac Ala Asn 1760	tca agc tac tcg gac Ser Ser Tyr Ser Asp 1765	gtg acg atg gcg cca Val Thr Met Ala Pro 1770	gca gca gac Ala Ala Asp 5319
atg ttt Met Phe 1775	gac caa ggt gtg aaa Asp Gln Gly Val Lys 1780	ctc caa gtc tta aaa Leu Gln Val Leu Lys 1785	cga gga acg Arg Gly Thr 5364



Ser Lys Tyr Ala Asp Thr Phe Cys Asn Glu Arg Tyr Gly Cys Ile Gln  
 65 70 75 80  
 Gln Gly Thr Asp Asn Glu His Asp Leu Leu Leu Gly Leu Ala Gln Glu  
 85 90 95  
 Ala Leu Ala Asp Ala Ala Gly Arg Met Glu Lys Gln Pro Ser Glu Ala  
 100 105 110  
 Phe Asp Leu Glu Asn Thr Gly Ile Val Ser Gly Cys Leu Ser Phe Pro  
 115 120 125  
 Met Asp Asn Leu Gln Gly Glu Leu Leu Asn Leu Tyr Gln Ser His Val  
 130 135 140  
 Glu Lys Gln Leu Pro Pro Ser Ala Leu Val Glu Ala Val Lys Leu Trp  
 145 150 155 160  
 Ser Glu Arg Gln Lys Ser Thr Lys Ala His Ala Gly Asp Lys Arg Arg  
 165 170 175  
 Phe Ile Asp Pro Ala Ser Phe Val Ala Asp Lys Leu Asn Leu Gly Pro  
 180 185 190  
 Leu His Tyr Ala Ile Asp Ala Ala Cys Ala Ser Ala Leu Tyr Val Leu  
 195 200 205  
 Lys Leu Ala Gln Asp His Leu Val Ser Gly Ala Val Asp Met Met Leu  
 210 215 220  
 Cys Gly Ala Thr Cys Phe Pro Glu Pro Phe Phe Ile Leu Ser Gly Phe  
 225 230 235 240  
 Ser Thr Phe Gln Ala Met Pro Xaa Gly Ala Asp Gly Val Ser Leu Pro  
 245 250 255  
 Leu His Lys Thr Ser Ala Gly Leu Thr Pro Gly Glu Gly Gly Ser Ile  
 260 265 270  
 Met Val Leu Lys Arg Leu Lys Asp Ala Ile Arg Asp Gly Asn His Ile  
 275 280 285  
 Tyr Gly Val Leu Leu Glu Ala Asn Leu Ser Asn Ala Gly Cys Gly Leu  
 290 295 300  
 Pro Leu Ser Pro His Leu Pro Ser Glu Glu Ser Cys Ile Arg Asp Thr  
 305 310 315 320  
 Tyr Arg Arg Ala Gly Val Ala Ala Asp Gln Ser Ile Gln Tyr Ile Glu  
 325 330 335

Cys His Ala Thr Gly Thr Pro Arg Gly Asp Val Val Glu Ile Glu Ala  
 340 345 350  
 Val Glu Arg Val Phe Lys Lys Asn Val Pro Arg Leu Gly Ser Thr Lys  
 355 360 365  
 Gly Asn Phe Gly His Ser Leu Val Ala Ala Gly Phe Ala Gly Met Ala  
 370 375 380  
 Lys Leu Leu Leu Ala Met Glu His Gly Val Ile Pro Pro Thr Pro Gly  
 385 390 395 400  
 Leu Asp Ala Ser Asn Gln Ala Ser Glu His Val Val Thr Lys Ala Ile  
 405 410 415  
 Thr Trp Pro Glu Thr His Gly Ala Pro Lys Arg Ala Gly Leu Ser Ala  
 420 425 430  
 Phe Gly Phe Gly Gly Thr Asn Ala His Ala Leu Phe Glu Glu Phe Asn  
 435 440 445  
 Ala Glu Gly Ile Ser Tyr Arg Pro Gly Lys Pro Pro Val Glu Ser Asn  
 450 455 460  
 Thr Arg Pro Ser Val Val Ile Thr Gly Met Asp Cys Thr Phe Gly Ser  
 465 470 475 480  
 Leu Glu Gly Ile Asp Ala Phe Glu Thr Ala Leu Tyr Glu Gly Arg Asp  
 485 490 495  
 Ala Ala Arg Asp Leu Pro Ala Lys Arg Trp Arg Phe Leu Gly Glu Asp  
 500 505 510  
 Leu Glu Phe Leu Arg Ala Ile Arg Leu Lys Glu Lys Pro Arg Gly Cys  
 515 520 525  
 Phe Val Glu Ser Val Asp Val Asn Phe Arg Arg Leu Lys Thr Pro Leu  
 530 535 540  
 Thr Pro Glu Asp Met Leu Arg Pro Gln Gln Leu Leu Ala Val Ser Thr  
 545 550 555 560  
 Met Asp Arg Ala Ile Ile Asp Ala Gly Leu Lys Lys Gly Gln His Val  
 565 570 575  
 Ala Val Leu Val Gly Leu Gly Thr Asp Leu Glu Leu Tyr Arg His Arg  
 580 585 590  
 Ala Arg Val Ala Leu Lys Glu Val Leu His Pro Ser Leu Lys Ser Asp  
 595 600 605

Thr Ala Ile Leu Gln Lys Ile Met Gln Tyr Val Asn Asp Ala Gly Thr  
 610 615 620

Ser Thr Ser Tyr Thr Ser Tyr Ile Gly Asn Leu Val Ala Thr Arg Ile  
 625 630 635 640

Ser Ser Gln Trp Gly Phe Thr Gly Pro Ser Phe Thr Val Thr Glu Gly  
 645 650 655

Asn Asn Ser Val Tyr Arg Cys Ala Gln Leu Ala Lys Asp Met Leu Gln  
 660 665 670

Val Asn Arg Val Asp Ala Val Val Ile Ala Gly Val Asp Leu Asn Gly  
 675 680 685

Ser Ala Glu Ser Phe Phe Val Arg Ala Asn Arg Gln Lys Ile Ser Lys  
 690 695 700

Leu Ser His Pro Cys Ala Ser Phe Asp Arg Asp Ala Asp Gly Phe Phe  
 705 710 715 720

Ala Gly Glu Gly Cys Gly Ala Leu Val Phe Lys Arg Leu Glu Asp Cys  
 725 730 735

Ala Pro Gln Glu Lys Ile Tyr Ala Ser Ile Asp Ser Ile Ala Ile Asp  
 740 745 750

Lys Glu Pro Thr Ser Ser Ala Val Lys Ala Val Tyr Gln Ser Asp Ser  
 755 760 765

Ser Leu Ser Asp Ile Glu Leu Leu Glu Ile Ser Gly Asp Ser Lys Arg  
 770 775 780

Phe Ala Ala Phe Glu Gly Ala Val Glu Ile Gln Ser Ser Val Glu Ala  
 785 790 795 800

Gln Leu Lys Gly Leu Ser Lys Val Leu Glu Pro Ala Lys Gly Gln Gly  
 805 810 815

Val Ala Val Gly Ser Thr Arg Ala Thr Val Gly Asp Ile Gly Tyr Ala  
 820 825 830

Thr Gly Ala Ala Ser Leu Ile Lys Thr Ala Leu Cys Leu Tyr Asn Arg  
 835 840 845

Tyr Leu Pro Ala Leu Ala Asn Trp Ser Gly Pro Cys Glu Gln Ser Ala  
 850 855 860

Trp Gly Ser Asn Met Phe Val Cys His Glu Thr Arg Pro Trp Met Lys  
 865 870 875 880

Asn Gln Asn Glu Lys Arg Cys Ala Leu Ile Ser Gly Thr Asp Pro Ser  
 885 890 895

His Thr Cys Phe Ser Leu Val Leu Ser Asp Thr Gly Cys Tyr Glu Glu  
 900 905 910

His Asn Arg Thr Cys Phe Asp Val Gln Ala Pro Gln Leu Val Leu Ile  
 915 920 925

His Gly Phe Asp Gly Lys Thr Ile Val Arg Arg Leu Glu Gly Tyr Leu  
 930 935 940

Leu Glu Leu Val Glu Gly His Ala Ser Pro Ser Glu Tyr Phe His Lys  
 945 950 955 960

Leu Ile Gly Gln Ser Leu Leu Glu Asn Ser Lys Glu Ser Lys Leu Thr  
 965 970 975

Leu Ser Leu Val Cys Asn Pro Asn Gln Leu Gln Lys Glu Leu Met Leu  
 980 985 990

Ala Ile Lys Gly Val Gln Arg Ser Met Leu Thr Gly Lys Asp Trp Val  
 995 1000 1005

Ser Pro Ser Gly Ser Cys Phe Ala Pro Asn Pro Leu Ser Ser Ala  
 1010 1015 1020

Lys Val Ala Phe Met Tyr Gly Glu Gly Arg Ser Pro Tyr Cys Gly  
 1025 1030 1035

Val Gly Leu Gly Leu His Arg Leu Trp Pro Gly Leu His Glu Asn  
 1040 1045 1050

Val Asn Asn Lys Thr Val Asp Leu Trp Thr Glu Gly Asp Gly Trp  
 1055 1060 1065

Leu Tyr Pro Arg Thr Leu Thr Arg Glu Glu His Thr Lys Ala Ile  
 1070 1075 1080

Glu Ser Phe Asn Ala Asn Gln Ile Glu Met Phe Arg Ala Gly Ile  
 1085 1090 1095

Phe Ile Ser Met Cys Gln Thr Asp Tyr Val Met Asn Val Leu Gly  
 1100 1105 1110

Val Gln Pro Lys Ala Gly Phe Gly Leu Ser Leu Gly Glu Ile Ser  
 1115 1120 1125

Met Leu Phe Ala Met Ser Lys Glu Asn Cys Arg Gln Ser Gln Glu  
 1130 1135 1140

Met	Thr	Asn	Arg	Leu	Arg	Gly	Ser	Pro	Val	Trp	Ser	Asn	Glu	Leu
1145						1150					1155			
Ala	Ile	Asn	Phe	Asn	Ala	Ile	Arg	Lys	Leu	Trp	Lys	Ile	Pro	Arg
1160						1165					1170			
Gly	Ala	Pro	Leu	Glu	Ser	Phe	Trp	Gln	Gly	Tyr	Leu	Val	His	Gly
1175						1180					1185			
Thr	Arg	Glu	Glu	Val	Glu	His	Ala	Ile	Gly	Leu	Ser	Glu	Pro	Tyr
1190						1195					1200			
Val	Arg	Leu	Leu	Ile	Val	Asn	Asp	Ser	Arg	Ser	Ala	Leu	Ile	Ala
1205						1210					1215			
Gly	Lys	Pro	Asp	Ala	Cys	Gln	Ala	Val	Ile	Ser	Arg	Leu	Asn	Ser
1220						1225					1230			
Lys	Phe	Pro	Ser	Leu	Pro	Val	Lys	Gln	Gly	Met	Ile	Gly	His	Cys
1235						1240					1245			
Pro	Glu	Val	Arg	Ala	Phe	Ile	Lys	Asp	Ile	Gly	Tyr	Ile	His	Glu
1250						1255					1260			
Thr	Leu	Arg	Ile	Ser	Asn	Asp	Tyr	Ser	Asp	Cys	Gln	Leu	Phe	Ser
1265						1270					1275			
Ala	Val	Thr	Lys	Gly	Ala	Leu	Asp	Ser	Ser	Thr	Met	Glu	Ile	Lys
1280						1285					1290			
His	Phe	Val	Gly	Glu	Val	Tyr	Ser	Arg	Ile	Ala	Asp	Phe	Pro	Gln
1295						1300					1305			
Ile	Val	Asn	Thr	Val	His	Ser	Ala	Gly	Tyr	Asp	Val	Phe	Leu	Glu
1310						1315					1320			
Leu	Gly	Cys	Asp	Ala	Ser	Arg	Ser	Ala	Ala	Val	Gln	Asn	Ile	Leu
1325						1330					1335			
Gly	Gly	Gln	Gly	Lys	Phe	Leu	Ser	Thr	Ala	Ile	Asp	Lys	Lys	Gly
1340						1345					1350			
His	Ser	Ala	Trp	Ser	Gln	Val	Leu	Arg	Ala	Thr	Ala	Ser	Leu	Ala
1355						1360					1365			
Ala	His	Arg	Val	Pro	Gly	Ile	Ser	Ile	Leu	Asp	Leu	Phe	His	Pro
1370						1375					1380			
Asn	Phe	Arg	Glu	Met	Cys	Cys	Thr	Met	Ala	Thr	Thr	Pro	Lys	Val
1385						1390					1395			

164



Ser	Ser	Asp	Gln	Ala	Arg	Met	Ala	Ala	Lys	Val	Pro	Met	Ala	Asp
1655						1660					1665			
Asp	Ile	Ala	Val	Glu	Ala	Asp	Ser	Gly	Gly	His	Thr	Asp	Asn	Arg
1670						1675					1680			
Pro	Met	His	Val	Ile	Leu	Pro	Leu	Ile	Ile	Gln	Leu	Arg	Asn	Thr
1685						1690					1695			
Ile	Leu	Ala	Glu	Tyr	Gly	Cys	Ala	Thr	Ala	Phe	Arg	Thr	Arg	Ile
1700						1705					1710			
Gly	Ala	Gly	Gly	Gly	Ile	Gly	Cys	Pro	Ser	Ala	Ala	Leu	Ala	Ala
1715						1720					1725			
Phe	Asp	Met	Gly	Ala	Ser	Phe	Val	Val	Thr	Gly	Ser	Ile	Asn	Gln
1730						1735					1740			
Ile	Cys	Arg	Glu	Ala	Gly	Thr	Cys	Asp	Thr	Val	Arg	Glu	Leu	Leu
1745						1750					1755			
Ala	Asn	Ser	Ser	Tyr	Ser	Asp	Val	Thr	Met	Ala	Pro	Ala	Ala	Asp
1760						1765					1770			
Met	Phe	Asp	Gln	Gly	Val	Lys	Leu	Gln	Val	Leu	Lys	Arg	Gly	Thr
1775						1780					1785			
Met	Phe	Pro	Ser	Arg	Ala	Asn	Lys	Leu	Arg	Lys	Leu	Phe	Val	Asn
1790						1795					1800			
Tyr	Glu	Ser	Leu	Glu	Thr	Leu	Pro	Ser	Lys	Glu	Leu	Lys	Tyr	Leu
1805						1810					1815			
Glu	Asn	Ile	Ile	Phe	Lys	Gln	Ala	Val	Asp	Gln	Val	Trp	Glu	Glu
1820						1825					1830			
Thr	Lys	Arg	Phe	Tyr	Cys	Glu	Lys	Leu	Asn	Asn	Pro	Asp	Lys	Ile
1835						1840					1845			
Ala	Arg	Ala	Met	Lys	Asp	Pro	Lys	Leu	Lys	Met	Ser	Leu	Cys	Phe
1850						1855					1860			
Arg	Trp	Tyr	Leu	Ser	Lys	Ser	Ser	Gly	Trp	Ala	Asn	Ala	Gly	Ile
1865						1870					1875			
Lys	Ser	Arg	Ala	Leu	Asp	Tyr	Gln	Ile	Trp	Cys	Gly	Pro	Ala	Met
1880						1885					1890			
Gly	Ser	Phe	Asn	Asn	Phe	Ala	Ser	Gly	Thr	Ser	Leu	Asp	Trp	Lys
1895						1900					1905			

Val Thr Gly Val Phe Pro Gly Val Ala Glu Val Asn Met Ala Ile  
 1910 1915 1920

Leu Asp Gly Ala Arg Glu Leu Ala Ala Lys Arg Asn  
 1925 1930 1935

<210> 53  
 <211> 1500  
 <212> DNA  
 <213> Thraustochytrium sp.

<220>  
 <221> CDS  
 <222> (1)..(1500)

<220>  
 <221> misc\_feature  
 <222> (1)..(1500)  
 <223> n = a c t o r g

<400> 53  
 atg caa ctt cct cca gcg cat tct gcc gat gag aat cgc atc gcg gtc 48  
 Met Gln Leu Pro Pro Ala His Ser Ala Asp Glu Asn Arg Ile Ala Val  
 1 5 10 15  
 gtg ggc atg gcc gtc aaa tat gcg ggc tgt gac aat aaa gaa gag ttt 96  
 Val Gly Met Ala Val Lys Tyr Ala Gly Cys Asp Asn Lys Glu Glu Phe  
 20 25 30  
 tgg aag act ttg atg aat ggt agt atc aat acc aag tcg att tcg gca 144  
 Trp Lys Thr Leu Met Asn Gly Ser Ile Asn Thr Lys Ser Ile Ser Ala  
 35 40 45  
 gca agg ttg ggc agc aat aag cgt gac gaa cac tat gtt cct gaa cga 192  
 Ala Arg Leu Gly Ser Asn Lys Arg Asp Glu His Tyr Val Pro Glu Arg  
 50 55 60  
 tcg aaa tat gca gat acg ttc tgt aac gaa agg tac ggt tgt atc cag 240  
 Ser Lys Tyr Ala Asp Thr Phe Cys Asn Glu Arg Tyr Gly Cys Ile Gln  
 65 70 75 80  
 caa ggt acg gat aat gag cat gac ctc ctc cta ggt ctt gct caa gaa 288  
 Gln Gly Thr Asp Asn Glu His Asp Leu Leu Leu Gly Leu Ala Gln Glu  
 85 90 95  
 gct ctc gct gac gct gcc ggg cgg atg gag aaa caa cct tcg gag gcg 336  
 Ala Leu Ala Asp Ala Ala Gly Arg Met Glu Lys Gln Pro Ser Glu Ala  
 100 105 110  
 ttc gat ctg gaa aat act ggc atc gtg agt ggg tgc tta tct ttt cca 384  
 Phe Asp Leu Glu Asn Thr Gly Ile Val Ser Gly Cys Leu Ser Phe Pro  
 115 120 125  
 atg gat aac ctg caa gga gag ttg ttg aac ttg tat caa agc cat gtg 432  
 Met Asp Asn Leu Gln Gly Glu Leu Leu Asn Leu Tyr Gln Ser His Val  
 130 135 140  
 gag aaa caa ctt cca cct agt gcc ttg gta gaa gcc gtg aag ctt tgg 480  
 Glu Lys Gln Leu Pro Pro Ser Ala Leu Val Glu Ala Val Lys Leu Trp  
 145 150 155 160  
 tct gag cga cag aaa tct acg aaa gca cat gca ggg gac aag cgc cgg 528  
 Ser Glu Arg Gln Lys Ser Thr Lys Ala His Ala Gly Asp Lys Arg Arg  
 165 170 175

ttc att gac cca gct tct ttt gta gct gat aaa ctg aac cta ggc cca Phe Ile Asp Pro Ala Ser Phe Val Ala Asp Lys Leu Asn Leu Gly Pro 180 185 190	576
cta cat tat gcg atc gat gca gca tgc gct tct gca ttg tac gtg tta Leu His Tyr Ala Ile Asp Ala Ala Cys Ala Ser Ala Leu Tyr Val Leu 195 200 205	624
aaa tta gct caa gac cac ctt gtt tca ggt gcc gtt gat atg atg tta Lys Leu Ala Gln Asp His Leu Val Ser Gly Ala Val Asp Met Met Leu 210 215 220	672
tgt gga gcg acg tgc ttc cca gaa cca ttc ttc atc ttg tct ggg ttc Cys Gly Ala Thr Cys Phe Pro Glu Pro Phe Phe Ile Leu Ser Gly Phe 225 230 235 240	720
tcg act ttt caa gcg atg cct gnt ggg gca gat gga gtc tca cta cct Ser Thr Phe Gln Ala Met Pro Xaa Gly Ala Asp Gly Val Ser Leu Pro 245 250 255	768
ctc cat aaa acg agt gct ggg ctc act cca ggt gaa ggg ggg tcc att Leu His Lys Thr Ser Ala Gly Leu Thr Pro Gly Glu Gly Gly Ser Ile 260 265 270	816
atg gtg ctc aag cga ctg aaa gac gct atc aga gat gga aat cac att Met Val Leu Lys Arg Leu Lys Asp Ala Ile Arg Asp Gly Asn His Ile 275 280 285	864
tat ggt gtg ctc ctt gaa gca aat tta agt aac gca ggt tgt ggg ctt Tyr Gly Val Leu Leu Glu Ala Asn Leu Ser Asn Ala Gly Cys Gly Leu 290 295 300	912
cca ctc agc ccg cac tta ccg agc gaa gaa tca tgt att cgt gat acc Pro Leu Ser Pro His Leu Pro Ser Glu Glu Ser Cys Ile Arg Asp Thr 305 310 315 320	960
tac cgc cgt gct gga gtt gct gca gat caa agt att cag tat att gag Tyr Arg Arg Ala Gly Val Ala Ala Asp Gln Ser Ile Gln Tyr Ile Glu 325 330 335	1008
tgc cac gct acg gga acc cct cga ggg gat gtc gtg gaa att gag gcg Cys His Ala Thr Gly Thr Pro Arg Gly Asp Val Val Glu Ile Glu Ala 340 345 350	1056
gtt gaa aga gtt ttc aag aaa aac gtt cca cgc tta ggc tcg acg aaa Val Glu Arg Val Phe Lys Lys Asn Val Pro Arg Leu Gly Ser Thr Lys 355 360 365	1104
gga aat ttt ggt cac tcg tta gtt gcg gct ggt ttc gca ggt atg gca Gly Asn Phe Gly His Ser Leu Val Ala Ala Gly Phe Ala Gly Met Ala 370 375 380	1152
aag ctt ctt ctt gca atg gaa cat gga gtg att cct ccc aca cca ggt Lys Leu Leu Leu Ala Met Glu His Gly Val Ile Pro Pro Thr Pro Gly 385 390 395 400	1200
ctt gat gct tcg aac cag gca agt gag cac gtt gtg aca aag gct atc Leu Asp Ala Ser Asn Gln Ala Ser Glu His Val Val Thr Lys Ala Ile 405 410 415	1248
act tgg cct gag aca cat ggg gct cca aaa cga gct ggc ctt tca gca Thr Trp Pro Glu Thr His Gly Ala Pro Lys Arg Ala Gly Leu Ser Ala 420 425 430	1296
ttt gga ttt ggt ggg act aat gcg cat gca ctc ttc gaa gag ttt aat Phe Gly Phe Gly Gly Thr Asn Ala His Ala Leu Phe Glu Glu Phe Asn 435 440 445	1344

gcc gag ggc ata agt tat cgc cct gga aag cct cca gtc gaa tcg aat 1392  
Ala Glu Gly Ile Ser Tyr Arg Pro Gly Lys Pro Pro Val Glu Ser Asn  
450 455 460

acc cgt cct tcc gtc gta ata act ggg atg gac tgt acc ttt ggg agc 1440  
Thr Arg Pro Ser Val Val Ile Thr Gly Met Asp Cys Thr Phe Gly Ser  
465 470 475 480

ctt gaa ggg att gat gcg ttc gag act gcc ctg tac gag ggg cgt gac 1488  
Leu Glu Gly Ile Asp Ala Phe Glu Thr Ala Leu Tyr Glu Gly Arg Asp  
485 490 495

gca gct cgt gac 1500  
Ala Ala Arg Asp  
500

<210> 54  
<211> 500  
<212> PRT  
<213> Thraustochytrium sp.

<220>  
<221> misc\_feature  
<222> (248)..(248)  
<223> The 'Xaa' at location 248 stands for Asp, Gly, Ala, or Val.

<400> 54

Met Gln Leu Pro Pro Ala His Ser Ala Asp Glu Asn Arg Ile Ala Val  
1 5 10 15

Val Gly Met Ala Val Lys Tyr Ala Gly Cys Asp Asn Lys Glu Glu Phe  
20 25 30

Trp Lys Thr Leu Met Asn Gly Ser Ile Asn Thr Lys Ser Ile Ser Ala  
35 40 45

Ala Arg Leu Gly Ser Asn Lys Arg Asp Glu His Tyr Val Pro Glu Arg  
50 55 60

Ser Lys Tyr Ala Asp Thr Phe Cys Asn Glu Arg Tyr Gly Cys Ile Gln  
65 70 75 80

Gln Gly Thr Asp Asn Glu His Asp Leu Leu Leu Gly Leu Ala Gln Glu  
85 90 95

Ala Leu Ala Asp Ala Ala Gly Arg Met Glu Lys Gln Pro Ser Glu Ala  
100 105 110

Phe Asp Leu Glu Asn Thr Gly Ile Val Ser Gly Cys Leu Ser Phe Pro  
115 120 125

Met Asp Asn Leu Gln Gly Glu Leu Leu Asn Leu Tyr Gln Ser His Val  
130 135 140

Glu Lys Gln Leu Pro Pro Ser Ala Leu Val Glu Ala Val Lys Leu Trp  
145 150 155 160

Ser Glu Arg Gln Lys Ser Thr Lys Ala His Ala Gly Asp Lys Arg Arg  
165 170 175

Phe Ile Asp Pro Ala Ser Phe Val Ala Asp Lys Leu Asn Leu Gly Pro  
180 185 190

Leu His Tyr Ala Ile Asp Ala Ala Cys Ala Ser Ala Leu Tyr Val Leu  
195 200 205

Lys Leu Ala Gln Asp His Leu Val Ser Gly Ala Val Asp Met Met Leu  
210 215 220

Cys Gly Ala Thr Cys Phe Pro Glu Pro Phe Phe Ile Leu Ser Gly Phe  
225 230 235 240

Ser Thr Phe Gln Ala Met Pro Xaa Gly Ala Asp Gly Val Ser Leu Pro  
245 250 255

Leu His Lys Thr Ser Ala Gly Leu Thr Pro Gly Glu Gly Gly Ser Ile  
260 265 270

Met Val Leu Lys Arg Leu Lys Asp Ala Ile Arg Asp Gly Asn His Ile  
275 280 285

Tyr Gly Val Leu Leu Glu Ala Asn Leu Ser Asn Ala Gly Cys Gly Leu  
290 295 300

Pro Leu Ser Pro His Leu Pro Ser Glu Glu Ser Cys Ile Arg Asp Thr  
305 310 315 320

Tyr Arg Arg Ala Gly Val Ala Ala Asp Gln Ser Ile Gln Tyr Ile Glu  
325 330 335

Cys His Ala Thr Gly Thr Pro Arg Gly Asp Val Val Glu Ile Glu Ala  
340 345 350

Val Glu Arg Val Phe Lys Lys Asn Val Pro Arg Leu Gly Ser Thr Lys  
355 360 365

Gly Asn Phe Gly His Ser Leu Val Ala Ala Gly Phe Ala Gly Met Ala  
370 375 380

Lys Leu Leu Leu Ala Met Glu His Gly Val Ile Pro Pro Thr Pro Gly  
385 390 395 400

Leu Asp Ala Ser Asn Gln Ala Ser Glu His Val Val Thr Lys Ala Ile  
405 410 415

Thr Trp Pro Glu Thr His Gly Ala Pro Lys Arg Ala Gly Leu Ser Ala  
420 425 430

Phe Gly Phe Gly Gly Thr Asn Ala His Ala Leu Phe Glu Glu Phe Asn  
 435 440 445

Ala Glu Gly Ile Ser Tyr Arg Pro Gly Lys Pro Pro Val Glu Ser Asn  
 450 455 460

Thr Arg Pro Ser Val Val Ile Thr Gly Met Asp Cys Thr Phe Gly Ser  
 465 470 475 480

Leu Glu Gly Ile Asp Ala Phe Glu Thr Ala Leu Tyr Glu Gly Arg Asp  
 485 490 495

Ala Ala Arg Asp  
 500

<210> 55  
 <211> 1500  
 <212> DNA  
 <213> Thraustochytrium sp.

<220>  
 <221> CDS  
 <222> (1) .. (1500)

<400> 55  
 tta ccc gcc aaa cgt tgg agg ttc cta ggt gag gac ttg gag ttt ctc 48  
 Leu Pro Ala Lys Arg Trp Arg Phe Leu Gly Glu Asp Leu Glu Phe Leu  
 1 5 10 15  
 cga gcc atc agg ctc aag gaa aag cct agg ggt tgt ttt gtg gag agt 96  
 Arg Ala Ile Arg Leu Lys Glu Lys Pro Arg Gly Cys Phe Val Glu Ser  
 20 25 30  
 gtt gac gtt aac ttt aga cgg ctg aaa acg ccc ttg aca cca gaa gat 144  
 Val Asp Val Asn Phe Arg Arg Leu Lys Thr Pro Leu Thr Pro Glu Asp  
 35 40 45  
 atg ttg cgg ccc caa caa ctc ttg gcg gtt tct acg atg gac cga gca 192  
 Met Leu Arg Pro Gln Gln Leu Leu Ala Val Ser Thr Met Asp Arg Ala  
 50 55 60  
 att atc gat gca ggt cta aag aag ggc caa cat gta gca gtt ctt gtt 240  
 Ile Ile Asp Ala Gly Leu Lys Lys Gly Gln His Val Ala Val Leu Val  
 65 70 75 80  
 ggc cta gga act gac ctg gaa ctt tac cgt cat cga gca aga gtc gcg 288  
 Gly Leu Gly Thr Asp Leu Glu Leu Tyr Arg His Arg Ala Arg Val Ala  
 85 90 95  
 ctt aaa gag gtt ttg cac ccg agc tta aag tca gac act gca att ctc 336  
 Leu Lys Glu Val Leu His Pro Ser Leu Lys Ser Asp Thr Ala Ile Leu  
 100 105 110  
 cag aaa ata atg caa tat gtg aat gat gca gga act tcg act tca tac 384  
 Gln Lys Ile Met Gln Tyr Val Asn Asp Ala Gly Thr Ser Thr Ser Tyr  
 115 120 125  
 aca tct tac att gga aac ctc gtt gcc acg cgt att tcg tct cag tgg 432  
 Thr Ser Tyr Ile Gly Asn Leu Val Ala Thr Arg Ile Ser Ser Gln Trp  
 130 135 140  
 gga ttc aca ggg ccg tcc ttt act gtc aca gaa gga aat aat tcc gtg 480

Gly 145	Phe	Thr	Gly	Pro	Ser 150	Phe	Thr	Val	Thr	Glu 155	Gly	Asn	Asn	Ser	Val 160	
tac	aga	tgt	gca	caa	cta	gcc	aaa	gat	atg	ctt	cag	gtt	aac	cga	gtt	528
Tyr	Arg	Cys	Ala	Gln	Leu	Ala	Lys	Asp	Met	Leu	Gln	Val	Asn	Arg	Val	
			165					170						175		
gat	gct	gtc	gtc	atc	gca	ggc	gtt	gat	ctc	aac	gga	agc	gcc	gaa	agt	576
Asp	Ala	Val	Val	Ile	Ala	Gly	Val	Asp	Leu	Asn	Gly	Ser	Ala	Glu	Ser	
			180					185					190			
ttt	ttt	gtc	cga	gca	aat	cgt	caa	aag	ata	tcc	aag	cta	agt	cat	cca	624
Phe	Phe	Val	Arg	Ala	Asn	Arg	Gln	Lys	Ile	Ser	Lys	Leu	Ser	His	Pro	
		195					200					205				
tgt	gca	agc	ttc	gac	aga	gat	gca	gat	gga	ttt	ttc	gca	ggg	gag	ggc	672
Cys	Ala	Ser	Phe	Asp	Arg	Asp	Ala	Asp	Gly	Phe	Phe	Ala	Gly	Glu	Gly	
	210					215					220					
tgt	ggg	gcc	cta	gtt	ttc	aag	agg	tta	gaa	gac	tgt	gct	cct	cag	gaa	720
Cys	Gly	Ala	Leu	Val	Phe	Lys	Arg	Leu	Glu	Asp	Cys	Ala	Pro	Gln	Glu	
	225				230					235					240	
aaa	att	tat	gct	agt	ata	gac	tct	atc	gca	ata	gat	aaa	gag	cct	act	768
Lys	Ile	Tyr	Ala	Ser	Ile	Asp	Ser	Ile	Ala	Ile	Asp	Lys	Glu	Pro	Thr	
				245					250					255		
agc	tca	gct	gtg	aaa	gct	gtc	tac	caa	agt	gat	tcg	agt	ctc	tcc	gat	816
Ser	Ser	Ala	Val	Lys	Ala	Val	Tyr	Gln	Ser	Asp	Ser	Ser	Leu	Ser	Asp	
			260					265					270			
att	gag	ctg	tta	gaa	atc	agt	gga	gac	tcc	aaa	cgg	ttt	gca	gca	ttc	864
Ile	Glu	Leu	Leu	Glu	Ile	Ser	Gly	Asp	Ser	Lys	Arg	Phe	Ala	Ala	Phe	
		275					280					285				
gaa	ggc	gct	gtg	gaa	att	caa	tca	agt	gtg	gaa	gcc	cag	cta	aaa	gga	912
Glu	Gly	Ala	Val	Glu	Ile	Gln	Ser	Ser	Val	Glu	Ala	Gln	Leu	Lys	Gly	
	290					295					300					
ctt	tcc	aaa	gtc	ctt	gaa	cct	gca	aaa	ggc	caa	ggc	gta	gcg	gtg	gga	960
Leu	Ser	Lys	Val	Leu	Glu	Pro	Ala	Lys	Gly	Gln	Gly	Val	Ala	Val	Gly	
	305				310					315					320	
agt	act	cga	gca	acc	gtt	ggg	gat	ata	ggg	tat	gct	aca	gga	gcg	gca	1008
Ser	Thr	Arg	Ala	Thr	Val	Gly	Asp	Ile	Gly	Tyr	Ala	Thr	Gly	Ala	Ala	
				325					330					335		
agc	ctg	att	aaa	act	gca	ctc	tgc	tta	tat	aat	cgc	tac	ctt	ccg	gca	1056
Ser	Leu	Ile	Lys	Thr	Ala	Leu	Cys	Leu	Tyr	Asn	Arg	Tyr	Leu	Pro	Ala	
			340					345					350			
tta	gca	aac	tgg	agt	ggc	cca	tgt	gaa	cag	tcc	gcc	tgg	ggc	tca	aac	1104
Leu	Ala	Asn	Trp	Ser	Gly	Pro	Cys	Glu	Gln	Ser	Ala	Trp	Gly	Ser	Asn	
		355					360					365				
atg	ttc	gtt	tgc	cat	gaa	aca	cgg	ccg	tgg	atg	aaa	aac	cag	aat	gaa	1152
Met	Phe	Val	Cys	His	Glu	Thr	Arg	Pro	Trp	Met	Lys	Asn	Gln	Asn	Glu	
	370					375				380						
aag	aga	tgt	gcc	ctc	att	tct	gga	aca	gat	cca	tct	cat	aca	tgc	ttt	1200
Lys	Arg	Cys	Ala	Leu	Ile	Ser	Gly	Thr	Asp	Pro	Ser	His	Thr	Cys	Phe	
	385				390					395					400	
tcc	ctc	gta	cta	tcg	gat	act	ggg	tgt	tat	gaa	gag	cac	aat	cga	acg	1248
Ser	Leu	Val	Leu	Ser	Asp	Thr	Gly	Cys	Tyr	Glu	Glu	His	Asn	Arg	Thr	
			405						410					415		
tgc	ttt	gat	gtg	caa	gcg	cca	cag	cta	gtt	ctg	ata	cac	gga	ttc	gat	1296

Cys Phe Asp Val Gln Ala Pro Gln Leu Val Leu Ile His Gly Phe Asp  
 420 425 430  
 gga aaa act att gtg cgg cga ctt gaa gga tat ctc ctt gaa ctt gtt 1344  
 Gly Lys Thr Ile Val Arg Arg Leu Glu Gly Tyr Leu Leu Glu Leu Val  
 435 440 445  
 gaa ggg cat gca agc cct tca gag tat ttc cac aaa ctg att gga caa 1392  
 Glu Gly His Ala Ser Pro Ser Glu Tyr Phe His Lys Leu Ile Gly Gln  
 450 455 460  
 agt cta ctt gag aac tcg aaa gaa agt aaa ctc aca ctt tcg ctt gtg 1440  
 Ser Leu Leu Glu Asn Ser Lys Glu Ser Lys Leu Thr Leu Ser Leu Val  
 465 470 475 480  
 tgc aat ccg aac cag ctc caa aag gag ctc atg ctt gct atc aaa gga 1488  
 Cys Asn Pro Asn Gln Leu Gln Lys Glu Leu Met Leu Ala Ile Lys Gly  
 485 490 495  
 gta caa cga agc 1500  
 Val Gln Arg Ser  
 500

<210> 56  
 <211> 500  
 <212> PRT  
 <213> Thraustochytrium sp.

<400> 56

Leu Pro Ala Lys Arg Trp Arg Phe Leu Gly Glu Asp Leu Glu Phe Leu  
 1 5 10 15  
 Arg Ala Ile Arg Leu Lys Glu Lys Pro Arg Gly Cys Phe Val Glu Ser  
 20 25 30  
 Val Asp Val Asn Phe Arg Arg Leu Lys Thr Pro Leu Thr Pro Glu Asp  
 35 40 45  
 Met Leu Arg Pro Gln Gln Leu Leu Ala Val Ser Thr Met Asp Arg Ala  
 50 55 60  
 Ile Ile Asp Ala Gly Leu Lys Lys Gly Gln His Val Ala Val Leu Val  
 65 70 75 80  
 Gly Leu Gly Thr Asp Leu Glu Leu Tyr Arg His Arg Ala Arg Val Ala  
 85 90 95  
 Leu Lys Glu Val Leu His Pro Ser Leu Lys Ser Asp Thr Ala Ile Leu  
 100 105 110  
 Gln Lys Ile Met Gln Tyr Val Asn Asp Ala Gly Thr Ser Thr Ser Tyr  
 115 120 125  
 Thr Ser Tyr Ile Gly Asn Leu Val Ala Thr Arg Ile Ser Ser Gln Trp  
 130 135 140  
 Gly Phe Thr Gly Pro Ser Phe Thr Val Thr Glu Gly Asn Asn Ser Val



145		150		155		160
Tyr Arg Cys Ala Gln Leu Ala Lys Asp Met Leu Gln Val Asn Arg Val	165		170		175	
Asp Ala Val Val Ile Ala Gly Val Asp Leu Asn Gly Ser Ala Glu Ser	180		185		190	
Phe Phe Val Arg Ala Asn Arg Gln Lys Ile Ser Lys Leu Ser His Pro	195		200		205	
Cys Ala Ser Phe Asp Arg Asp Ala Asp Gly Phe Phe Ala Gly Glu Gly	210		215		220	
Cys Gly Ala Leu Val Phe Lys Arg Leu Glu Asp Cys Ala Pro Gln Glu	225		230		235	240
Lys Ile Tyr Ala Ser Ile Asp Ser Ile Ala Ile Asp Lys Glu Pro Thr	245		250		255	
Ser Ser Ala Val Lys Ala Val Tyr Gln Ser Asp Ser Ser Leu Ser Asp	260		265		270	
Ile Glu Leu Leu Glu Ile Ser Gly Asp Ser Lys Arg Phe Ala Ala Phe	275		280		285	
Glu Gly Ala Val Glu Ile Gln Ser Ser Val Glu Ala Gln Leu Lys Gly	290		295		300	
Leu Ser Lys Val Leu Glu Pro Ala Lys Gly Gln Gly Val Ala Val Gly	305		310		315	320
Ser Thr Arg Ala Thr Val Gly Asp Ile Gly Tyr Ala Thr Gly Ala Ala	325		330		335	
Ser Leu Ile Lys Thr Ala Leu Cys Leu Tyr Asn Arg Tyr Leu Pro Ala	340		345		350	
Leu Ala Asn Trp Ser Gly Pro Cys Glu Gln Ser Ala Trp Gly Ser Asn	355		360		365	
Met Phe Val Cys His Glu Thr Arg Pro Trp Met Lys Asn Gln Asn Glu	370		375		380	
Lys Arg Cys Ala Leu Ile Ser Gly Thr Asp Pro Ser His Thr Cys Phe	385		390		395	400
Ser Leu Val Leu Ser Asp Thr Gly Cys Tyr Glu Glu His Asn Arg Thr	405		410		415	
Cys Phe Asp Val Gln Ala Pro Gln Leu Val Leu Ile His Gly Phe Asp						

420

425

430

Gly Lys Thr Ile Val Arg Arg Leu Glu Gly Tyr Leu Leu Glu Leu Val  
 435 440 445

Glu Gly His Ala Ser Pro Ser Glu Tyr Phe His Lys Leu Ile Gly Gln  
 450 455 460

Ser Leu Leu Glu Asn Ser Lys Glu Ser Lys Leu Thr Leu Ser Leu Val  
 465 470 475 480

Cys Asn Pro Asn Gln Leu Gln Lys Glu Leu Met Leu Ala Ile Lys Gly  
 485 490 495

Val Gln Arg Ser  
 500

<210> 57  
 <211> 1500  
 <212> DNA  
 <213> Thraustochytrium sp.

<220>  
 <221> CDS  
 <222> (1)..(1500)

<400> 57  
 atg tta aca ggg aag gat tgg gtc agt cca tca gga agt tgt ttt gcc 48  
 Met Leu Thr Gly Lys Asp Trp Val Ser Pro Ser Gly Ser Cys Phe Ala  
 1 5 10 15  
 cca aat ccg tta tca agc gca aaa gtg gca ttc atg tac gga gaa ggc 96  
 Pro Asn Pro Leu Ser Ser Ala Lys Val Ala Phe Met Tyr Gly Glu Gly  
 20 25 30  
 cga agc ccg tac tgt ggt gta ggc ttg ggt cta cat cgt ttg tgg ccc 144  
 Arg Ser Pro Tyr Cys Gly Val Gly Leu Gly Leu His Arg Leu Trp Pro  
 35 40 45  
 ggt ctc cat gaa aat gtg aac aat aag aca gtc gat tta tgg acg gaa 192  
 Gly Leu His Glu Asn Val Asn Asn Lys Thr Val Asp Leu Trp Thr Glu  
 50 55 60  
 gga gat ggt tgg tta tat cct cga acg ttg aca cga gaa gag cat aca 240  
 Gly Asp Gly Trp Leu Tyr Pro Arg Thr Leu Thr Arg Glu Glu His Thr  
 65 70 75 80  
 aaa gcc atc gaa tct ttc aac gca aat caa att gaa atg ttt cgc gct 288  
 Lys Ala Ile Glu Ser Phe Asn Ala Asn Gln Ile Glu Met Phe Arg Ala  
 85 90 95  
 ggg att ttc atc tca atg tgt cag aca gac tat gtc atg aat gtt ctc 336  
 Gly Ile Phe Ile Ser Met Cys Gln Thr Asp Tyr Val Met Asn Val Leu  
 100 105 110  
 ggt gtc cag cct aag gcc gga ttt ggg ctg agc ttg gga gaa att tca 384  
 Gly Val Gln Pro Lys Ala Gly Phe Gly Leu Ser Leu Gly Glu Ile Ser  
 115 120 125  
 atg ctc ttt gcg atg tca aag gag aac tgc agg cag tca cag gaa atg 432  
 Met Leu Phe Ala Met Ser Lys Glu Asn Cys Arg Gln Ser Gln Glu Met

130	135	140	
acc aat cgt ttg cgc ggt tct cca gtg tgg tct aac gag ctt gct atc Thr Asn Arg Leu Arg Gly Ser Pro Val Trp Ser Asn Glu Leu Ala Ile 145 150 155 160			480
aac ttc aat gca att cgc aag tta tgg aaa atc ccc cga gga gct ccc Asn Phe Asn Ala Ile Arg Lys Leu Trp Lys Ile Pro Arg Gly Ala Pro 165 170 175			528
tta gaa tcc ttt tgg caa gga tac ttg gtt cac ggc aca aga gaa gaa Leu Glu Ser Phe Trp Gln Gly Tyr Leu Val His Gly Thr Arg Glu Glu 180 185 190			576
gta gag cat gct att ggt ctt tct gag cct tat gta cgt ctg ctt att Val Glu His Ala Ile Gly Leu Ser Glu Pro Tyr Val Arg Leu Leu Ile 195 200 205			624
gtg aac gat tca agg agt gcc ttg att gct gga aaa cca gac gcc tgt Val Asn Asp Ser Arg Ser Ala Leu Ile Ala Gly Lys Pro Asp Ala Cys 210 215 220			672
cag gca gta atc agt aga cta aac tcc aag ttc cct tct ctg ccg gta Gln Ala Val Ile Ser Arg Leu Asn Ser Lys Phe Pro Ser Leu Pro Val 225 230 235 240			720
aag caa gga atg att ggt cat tgc cca gaa gtt cgt gcg ttc atc aaa Lys Gln Gly Met Ile Gly His Cys Pro Glu Val Arg Ala Phe Ile Lys 245 250 255			768
gat att ggg tac atc cat gaa aca ctc cga att tcc aat gac tat tgc Asp Ile Gly Tyr Ile His Glu Thr Leu Arg Ile Ser Asn Asp Tyr Ser 260 265 270			816
gat tgt cag ctt ttc tca gcg gta acc aag ggc gca ctt gac agc tcc Asp Cys Gln Leu Phe Ser Ala Val Thr Lys Gly Ala Leu Asp Ser Ser 275 280 285			864
aca atg gaa atc aaa cac ttt gtg gga gag gtc tac tcc cgg atc gca Thr Met Glu Ile Lys His Phe Val Gly Glu Val Tyr Ser Arg Ile Ala 290 295 300			912
gac ttt cct caa atc gtc aac acg gtg cat tgc gct ggt tat gac gta Asp Phe Pro Gln Ile Val Asn Thr Val His Ser Ala Gly Tyr Asp Val 305 310 315 320			960
ttt ctt gag ctt ggc tgt gat gct tct aga tct gca gca gtt caa aac Phe Leu Glu Leu Gly Cys Asp Ala Ser Arg Ser Ala Ala Val Gln Asn 325 330 335			1008
att ctt ggt ggt caa gga aag ttc ttg tct aca gct att gac aaa aaa Ile Leu Gly Gly Gln Gly Lys Phe Leu Ser Thr Ala Ile Asp Lys Lys 340 345 350			1056
gga cac tcc gcc tgg tca caa gta ctt cgg gct acc gca tca tta gct Gly His Ser Ala Trp Ser Gln Val Leu Arg Ala Thr Ala Ser Leu Ala 355 360 365			1104
gca cat cga gta ccg gga atc tca att ttg gat ttg ttt cac cca aat Ala His Arg Val Pro Gly Ile Ser Ile Leu Asp Leu Phe His Pro Asn 370 375 380			1152
ttc cga gaa atg tgc tgt aca atg gca acc aca cct aaa gtg gaa gat Phe Arg Glu Met Cys Cys Thr Met Ala Thr Thr Pro Lys Val Glu Asp 385 390 395 400			1200
aag ttc ctg cgc acg att caa atc aat ggt cgg ttt gaa aaa gaa atg Lys Phe Leu Arg Thr Ile Gln Ile Asn Gly Arg Phe Glu Lys Glu Met			1248

405	410	415	
att cac cta gaa gat aca aca tta agt tgc tta ccc gct cca agt gaa Ile His Leu Glu Asp Thr Thr Leu Ser Cys Leu Pro Ala Pro Ser Glu 420 425 430			1296
gca aat atc gca gct att caa tct cgg tca att cga tct gct gcg gcg Ala Asn Ile Ala Ala Ile Gln Ser Arg Ser Ile Arg Ser Ala Ala Ala 435 440 445			1344
cgt tct gga caa tcc cat gat tgt gca tcc cat agc cat gaa gaa aat Arg Ser Gly Gln Ser His Asp Cys Ala Ser His Ser His Glu Glu Asn 450 455 460			1392
aag gat tca tgc cct gaa aag ctg aag ctt gat tct gtg tcc gtc gcc Lys Asp Ser Cys Pro Glu Lys Leu Lys Leu Asp Ser Val Ser Val Ala 465 470 475 480			1440
ata aat ttc gac aat gat gac cgc att cag ctt ggg cac gcg ggt ttt Ile Asn Phe Asp Asn Asp Asp Arg Ile Gln Leu Gly His Ala Gly Phe 485 490 495			1488
cgg gag atg tac Arg Glu Met Tyr 500			1500

<210> 58  
 <211> 500  
 <212> PRT  
 <213> Thraustochytrium sp.

<400> 58

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Pro Asn Pro Leu Ser Ser Ala Lys Val Ala Phe Met Tyr Gly Glu Gly 20 25 30
Arg Ser Pro Tyr Cys Gly Val Gly Leu Gly Leu His Arg Leu Trp Pro 35 40 45
Gly Leu His Glu Asn Val Asn Asn Lys Thr Val Asp Leu Trp Thr Glu 50 55 60
Gly Asp Gly Trp Leu Tyr Pro Arg Thr Leu Thr Arg Glu Glu His Thr 65 70 75 80
Lys Ala Ile Glu Ser Phe Asn Ala Asn Gln Ile Glu Met Phe Arg Ala 85 90 95
Gly Ile Phe Ile Ser Met Cys Gln Thr Asp Tyr Val Met Asn Val Leu 100 105 110
Gly Val Gln Pro Lys Ala Gly Phe Gly Leu Ser Leu Gly Glu Ile Ser 115 120 125
Met Leu Phe Ala Met Ser Lys Glu Asn Cys Arg Gln Ser Gln Glu Met 130 135 140

Thr Asn Arg Leu Arg Gly Ser Pro Val Trp Ser Asn Glu Leu Ala Ile  
 145 150 155 160

Asn Phe Asn Ala Ile Arg Lys Leu Trp Lys Ile Pro Arg Gly Ala Pro  
 165 170 175

Leu Glu Ser Phe Trp Gln Gly Tyr Leu Val His Gly Thr Arg Glu Glu  
 180 185 190

Val Glu His Ala Ile Gly Leu Ser Glu Pro Tyr Val Arg Leu Leu Ile  
 195 200 205

Val Asn Asp Ser Arg Ser Ala Leu Ile Ala Gly Lys Pro Asp Ala Cys  
 210 215 220

Gln Ala Val Ile Ser Arg Leu Asn Ser Lys Phe Pro Ser Leu Pro Val  
 225 230 235 240

Lys Gln Gly Met Ile Gly His Cys Pro Glu Val Arg Ala Phe Ile Lys  
 245 250 255

Asp Ile Gly Tyr Ile His Glu Thr Leu Arg Ile Ser Asn Asp Tyr Ser  
 260 265 270

Asp Cys Gln Leu Phe Ser Ala Val Thr Lys Gly Ala Leu Asp Ser Ser  
 275 280 285

Thr Met Glu Ile Lys His Phe Val Gly Glu Val Tyr Ser Arg Ile Ala  
 290 295 300

Asp Phe Pro Gln Ile Val Asn Thr Val His Ser Ala Gly Tyr Asp Val  
 305 310 315 320

Phe Leu Glu Leu Gly Cys Asp Ala Ser Arg Ser Ala Ala Val Gln Asn  
 325 330 335

Ile Leu Gly Gly Gln Gly Lys Phe Leu Ser Thr Ala Ile Asp Lys Lys  
 340 345 350

Gly His Ser Ala Trp Ser Gln Val Leu Arg Ala Thr Ala Ser Leu Ala  
 355 360 365

Ala His Arg Val Pro Gly Ile Ser Ile Leu Asp Leu Phe His Pro Asn  
 370 375 380

Phe Arg Glu Met Cys Cys Thr Met Ala Thr Thr Pro Lys Val Glu Asp  
 385 390 395 400

Lys Phe Leu Arg Thr Ile Gln Ile Asn Gly Arg Phe Glu Lys Glu Met  
 405 410 415

Ile His Leu Glu Asp Thr Thr Leu Ser Cys Leu Pro Ala Pro Ser Glu  
420 425 430

Ala Asn Ile Ala Ala Ile Gln Ser Arg Ser Ile Arg Ser Ala Ala Ala  
435 440 445

Arg Ser Gly Gln Ser His Asp Cys Ala Ser His Ser His Glu Glu Asn  
450 455 460

Lys Asp Ser Cys Pro Glu Lys Leu Lys Leu Asp Ser Val Ser Val Ala  
465 470 475 480

Ile Asn Phe Asp Asn Asp Asp Arg Ile Gln Leu Gly His Ala Gly Phe  
485 490 495

Arg Glu Met Tyr  
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<211> 1305  
<212> DNA  
<213> Thraustochytrium sp.

<220>  
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<222> (1)..(1305)

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tct gca gat ctt gtc att gcc gct ggg aaa gag ggc atc cta gct tcc 96  
Ser Ala Asp Leu Val Ile Ala Ala Gly Lys Glu Gly Ile Leu Ala Ser  
20 25 30

tat gga gct gga gga cta cct ctt gct act gtt cga aag gga ata gac 144  
Tyr Gly Ala Gly Gly Leu Pro Leu Ala Thr Val Arg Lys Gly Ile Asp  
35 40 45

aaa att caa caa gcc ttg cca agt ggc cca tat gct gta aat ctt att 192  
Lys Ile Gln Gln Ala Leu Pro Ser Gly Pro Tyr Ala Val Asn Leu Ile  
50 55 60

cac tct ccc ttt gac ggc aac ttg gag cag gga aac gtc gat ttg ttc 240  
His Ser Pro Phe Asp Gly Asn Leu Glu Gln Gly Asn Val Asp Leu Phe  
65 70 75 80

ttg gaa aag aac gtc cgc gtg gcg gaa tgt tcc gcg ttt aca acg cta 288  
Leu Glu Lys Asn Val Arg Val Ala Glu Cys Ser Ala Phe Thr Thr Leu  
85 90 95

aca gtg cca gta gta cac tat cgt gct gca ggg ctt gtt cgg cgc caa 336  
Thr Val Pro Val Val His Tyr Arg Ala Ala Gly Leu Val Arg Arg Gln  
100 105 110

gat gga agc att ttg atc aag aac cga atc att gct aaa gta tct agg 384  
Asp Gly Ser Ile Leu Ile Lys Asn Arg Ile Ile Ala Lys Val Ser Arg  
115 120 125

aca gaa ctc gct gag atg ttc ctt cgt ccg gca cct caa atc atc ctc 432

Thr	Glu	Leu	Ala	Glu	Met	Phe	Leu	Arg	Pro	Ala	Pro	Gln	Ile	Ile	Leu		
130						135					140						
gaa	aaa	ctg	gta	gca	gca	gaa	atc	att	tca	tct	gac	caa	gcg	cgt	atg	480	
Glu	Lys	Leu	Val	Ala	Ala	Glu	Ile	Ile	Ser	Ser	Asp	Gln	Ala	Arg	Met	160	
145						150					155						
gca	gcc	aaa	gtt	ccc	atg	gcg	gac	gac	atc	gca	gtc	gaa	gcc	gac	tct	528	
Ala	Ala	Lys	Val	Pro	Met	Ala	Asp	Asp	Ile	Ala	Val	Glu	Ala	Asp	Ser		
				165					170						175		
ggg	ggg	cac	acg	gat	aat	cgg	cct	atg	cac	gtc	att	ttg	ccc	ctg	ata	576	
Gly	Gly	His	Thr	Asp	Asn	Arg	Pro	Met	His	Val	Ile	Leu	Pro	Leu	Ile		
			180					185						190			
att	caa	ctc	cgc	aat	act	ata	ctt	gca	gag	tat	ggc	tgt	gcc	acg	gct	624	
Ile	Gln	Leu	Arg	Asn	Thr	Ile	Leu	Ala	Glu	Tyr	Gly	Cys	Ala	Thr	Ala		
		195					200					205					
ttt	cgt	acc	cgt	ata	ggc	gct	gga	gga	ggc	att	ggg	tgt	cct	tca	gcg	672	
Phe	Arg	Thr	Arg	Ile	Gly	Ala	Gly	Gly	Gly	Ile	Gly	Cys	Pro	Ser	Ala		
	210					215					220						
gcc	ctc	gca	gcc	ttt	gat	atg	ggg	gcg	agt	ttt	gtc	gtg	act	gga	agc	720	
Ala	Leu	Ala	Ala	Phe	Asp	Met	Gly	Ala	Ser	Phe	Val	Val	Thr	Gly	Ser		
					230					235					240		
ata	aat	caa	att	tgc	cgc	gag	gca	ggg	act	tgc	gat	act	gtt	cgg	gag	768	
Ile	Asn	Gln	Ile	Cys	Arg	Glu	Ala	Gly	Thr	Cys	Asp	Thr	Val	Arg	Glu		
				245					250					255			
cta	ctt	gcc	aac	tca	agc	tac	tcg	gac	gtg	acg	atg	gcg	cca	gca	gca	816	
Leu	Leu	Ala	Asn	Ser	Ser	Tyr	Ser	Asp	Val	Thr	Met	Ala	Pro	Ala	Ala		
			260					265					270				
gac	atg	ttt	gac	caa	ggg	gtg	aaa	ctc	caa	gtc	tta	aaa	cga	gga	acg	864	
Asp	Met	Phe	Asp	Gln	Gly	Val	Lys	Leu	Gln	Val	Leu	Lys	Arg	Gly	Thr		
		275				280					285						
atg	ttt	cca	agc	aga	gca	aat	aaa	ctc	cgg	aag	ctc	ttt	gtg	aac	tac	912	
Met	Phe	Pro	Ser	Arg	Ala	Asn	Lys	Leu	Arg	Lys	Leu	Phe	Val	Asn	Tyr		
		290				295					300						
gaa	tct	cta	gaa	aca	ctc	cgg	tcg	aaa	gag	ttg	aaa	tac	ctg	gaa	aac	960	
Glu	Ser	Leu	Glu	Thr	Leu	Pro	Ser	Lys	Glu	Leu	Lys	Tyr	Leu	Glu	Asn		
					310					315					320		
atc	ata	ttc	aag	caa	gca	gta	gac	cag	gtg	tgg	gag	gaa	aca	aag	cgc	1008	
Ile	Ile	Phe	Lys	Gln	Ala	Val	Asp	Gln	Val	Trp	Glu	Glu	Thr	Lys	Arg		
				325					330					335			
ttt	tac	tgt	gaa	aaa	ctg	aac	aat	cca	gat	aaa	att	gca	agg	gcc	atg	1056	
Phe	Tyr	Cys	Glu	Lys	Leu	Asn	Asn	Pro	Asp	Lys	Ile	Ala	Arg	Ala	Met		
			340					345					350				
aaa	gat	cct	aaa	ttg	aag	atg	tcg	ctt	tgc	ttt	cgg	tgg	tat	ctc	tcc	1104	
Lys	Asp	Pro	Lys	Leu	Lys	Met	Ser	Leu	Cys	Phe	Arg	Trp	Tyr	Leu	Ser		
		355					360					365					
aag	agc	tct	ggg	tgg	gcc	aac	gca	gga	att	aaa	tct	cgt	gca	ctc	gac	1152	
Lys	Ser	Ser	Gly	Trp	Ala	Asn	Ala	Gly	Ile	Lys	Ser	Arg	Ala	Leu	Asp		
		370				375					380						
tac	cag	atc	tgg	tgt	ggc	cgg	gca	atg	ggc	tcg	ttc	aac	aat	ttc	gcc	1200	
Tyr	Gln	Ile	Trp	Cys	Gly	Pro	Ala	Met	Gly	Ser	Phe	Asn	Asn	Phe	Ala		
				390						395					400		
agc	ggc	aca	tcc	ctc	gat	tgg	aaa	gtg	act	ggg	gtt	ttc	cct	ggc	gtt	1248	

Ser Gly Thr Ser Leu Asp Trp Lys Val Thr Gly Val Phe Pro Gly Val  
 405 410 415  
 gcg gaa gta aac atg gcc att tta gat ggc gcg cga gaa cta gct gct 1296  
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 Lys Arg Asn  
 435  
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 <400> 60  
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 Ser Ala Asp Leu Val Ile Ala Ala Gly Lys Glu Gly Ile Leu Ala Ser  
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 Tyr Gly Ala Gly Gly Leu Pro Leu Ala Thr Val Arg Lys Gly Ile Asp  
 35 40 45  
 Lys Ile Gln Gln Ala Leu Pro Ser Gly Pro Tyr Ala Val Asn Leu Ile  
 50 55 60  
 His Ser Pro Phe Asp Gly Asn Leu Glu Gln Gly Asn Val Asp Leu Phe  
 65 70 75 80  
 Leu Glu Lys Asn Val Arg Val Ala Glu Cys Ser Ala Phe Thr Thr Leu  
 85 90 95  
 Thr Val Pro Val Val His Tyr Arg Ala Ala Gly Leu Val Arg Arg Gln  
 100 105 110  
 Asp Gly Ser Ile Leu Ile Lys Asn Arg Ile Ile Ala Lys Val Ser Arg  
 115 120 125  
 Thr Glu Leu Ala Glu Met Phe Leu Arg Pro Ala Pro Gln Ile Ile Leu  
 130 135 140  
 Glu Lys Leu Val Ala Ala Glu Ile Ile Ser Ser Asp Gln Ala Arg Met  
 145 150 155 160  
 Ala Ala Lys Val Pro Met Ala Asp Asp Ile Ala Val Glu Ala Asp Ser  
 165 170 175  
 Gly Gly His Thr Asp Asn Arg Pro Met His Val Ile Leu Pro Leu Ile  
 180 185 190  
 Ile Gln Leu Arg Asn Thr Ile Leu Ala Glu Tyr Gly Cys Ala Thr Ala



195                      200                      205  
 Phe Arg Thr Arg Ile Gly Ala Gly Gly Gly Ile Gly Cys Pro Ser Ala  
     210                      215                      220  
 Ala Leu Ala Ala Phe Asp Met Gly Ala Ser Phe Val Val Thr Gly Ser  
     225                      230                      235                      240  
 Ile Asn Gln Ile Cys Arg Glu Ala Gly Thr Cys Asp Thr Val Arg Glu  
                     245                      250                      255  
 Leu Leu Ala Asn Ser Ser Tyr Ser Asp Val Thr Met Ala Pro Ala Ala  
                     260                      265                      270  
 Asp Met Phe Asp Gln Gly Val Lys Leu Gln Val Leu Lys Arg Gly Thr  
                     275                      280                      285  
 Met Phe Pro Ser Arg Ala Asn Lys Leu Arg Lys Leu Phe Val Asn Tyr  
                     290                      295                      300  
 Glu Ser Leu Glu Thr Leu Pro Ser Lys Glu Leu Lys Tyr Leu Glu Asn  
     305                      310                      315                      320  
 Ile Ile Phe Lys Gln Ala Val Asp Gln Val Trp Glu Glu Thr Lys Arg  
                     325                      330                      335  
 Phe Tyr Cys Glu Lys Leu Asn Asn Pro Asp Lys Ile Ala Arg Ala Met  
                     340                      345                      350  
 Lys Asp Pro Lys Leu Lys Met Ser Leu Cys Phe Arg Trp Tyr Leu Ser  
                     355                      360                      365  
 Lys Ser Ser Gly Trp Ala Asn Ala Gly Ile Lys Ser Arg Ala Leu Asp  
                     370                      375                      380  
 Tyr Gln Ile Trp Cys Gly Pro Ala Met Gly Ser Phe Asn Asn Phe Ala  
     385                      390                      395                      400  
 Ser Gly Thr Ser Leu Asp Trp Lys Val Thr Gly Val Phe Pro Gly Val  
                     405                      410                      415  
 Ala Glu Val Asn Met Ala Ile Leu Asp Gly Ala Arg Glu Leu Ala Ala  
                     420                      425                      430  
 Lys Arg Asn  
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 <212> DNA  
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<220>  
 <221> CDS  
 <222> (1)..(4410)

<400> 61

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aag tcc gag ctg tgt gat gac cgc acg gta gtc ttt gac tat gag gag	96
Lys Ser Glu Leu Cys Asp Asp Arg Thr Val Val Phe Asp Tyr Glu Glu	
20 25 30	
ctg ctg gag ttc gct gag ggc gat atc agt aag gtt ttt ggg ccg gag	144
Leu Leu Glu Phe Ala Glu Gly Asp Ile Ser Lys Val Phe Gly Pro Glu	
35 40 45	
ttc aaa gtg gtg gac ggg ttt agg cgc agg gtg agg ttg ccc gct cga	192
Phe Lys Val Val Asp Gly Phe Arg Arg Arg Val Arg Leu Pro Ala Arg	
50 55 60	
gag tac ctg ctg gtg acc cgg gtt acg ctg atg gat gcc gag gtg ggc	240
Glu Tyr Leu Leu Val Thr Arg Val Thr Leu Met Asp Ala Glu Val Gly	
65 70 75 80	
aac ttt cga gtg gga gca cgt atg gtg aca gag tat gac gta cct gtg	288
Asn Phe Arg Val Gly Ala Arg Met Val Thr Glu Tyr Asp Val Pro Val	
85 90 95	
aac gga gag ctc tcg gaa ggg gga gat gtg ccg tgg gct gtg ttg gtg	336
Asn Gly Glu Leu Ser Glu Gly Gly Asp Val Pro Trp Ala Val Leu Val	
100 105 110	
gaa gcc ggg cag tgc gac ttg ctg cta att tct tac atg ggc atc gat	384
Glu Ala Gly Gln Cys Asp Leu Leu Leu Ile Ser Tyr Met Gly Ile Asp	
115 120 125	
ttc cag tgc aaa gga gag cgg gtc tac cgg ctg ctg aac acc acc ttg	432
Phe Gln Cys Lys Gly Glu Arg Val Tyr Arg Leu Leu Asn Thr Thr Leu	
130 135 140	
acg ttt ttt ggc gtc gcg aaa gaa ggg gaa acg ctt gtg tac gat att	480
Thr Phe Phe Gly Val Ala Lys Glu Gly Glu Thr Leu Val Tyr Asp Ile	
145 150 155 160	
cgc gtc acg ggt ttc gcc aag agg ccg gac gga gat atc tcc atg ttc	528
Arg Val Thr Gly Phe Ala Lys Arg Pro Asp Gly Asp Ile Ser Met Phe	
165 170 175	
ttt ttc gaa tat gat tgc tac tgc aat ggc aag ctt ctc atc gaa atg	576
Phe Phe Glu Tyr Asp Cys Tyr Cys Asn Gly Lys Leu Leu Ile Glu Met	
180 185 190	
cga gat ggc tct gca ggc ttc ttc acg gac gaa gag ctc gct gcc ggc	624
Arg Asp Gly Ser Ala Gly Phe Phe Thr Asp Glu Glu Leu Ala Ala Gly	
195 200 205	
aaa gga gtg gtc gtc act cgt gca cag caa aac atg cgg gac aaa att	672
Lys Gly Val Val Val Thr Arg Ala Gln Gln Asn Met Arg Asp Lys Ile	
210 215 220	
gta cgg cag tcc att gag cct ttt gca ctg gcg gct tgc acg cac aaa	720
Val Arg Gln Ser Ile Glu Pro Phe Ala Leu Ala Cys Thr His Lys	
225 230 235 240	
acg act ctg aac gag agt gac atg cag tcc ctt gtg gag cga aac tgg	768
Thr Thr Leu Asn Glu Ser Asp Met Gln Ser Leu Val Glu Arg Asn Trp	
245 250 255	

gca aac gtt ttt ggc acc agt aac aag atg gcg gag ctc aac tat aaa Ala Asn Val Phe Gly Thr Ser Asn Lys Met Ala Glu Leu Asn Tyr Lys 260 265 270	816
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cac cac ggt ggg gcg tat ggc ctc gga cta ctt gtt gga gag aag atc His His Gly Gly Ala Tyr Gly Leu Gly Leu Leu Val Gly Glu Lys Ile 290 295 300	912
ttg gat cga aac cat tgg tac ttt cct tgt cac ttt gtc aat gat caa Leu Asp Arg Asn His Trp Tyr Phe Pro Cys His Phe Val Asn Asp Gln 305 310 315 320	960
gtc atg gca ggg tca ctg gtc agc gat ggt tgc agc cag ctc tta aaa Val Met Ala Gly Ser Leu Val Ser Asp Gly Cys Ser Gln Leu Leu Lys 325 330 335	1008
ctc tat atg atc tgg ctt ggc ctc cac ctg aaa atg gag gaa ttt gat Leu Tyr Met Ile Trp Leu Gly Leu His Leu Lys Met Glu Glu Phe Asp 340 345 350	1056
ttt ctc cca gtt agc ggc cac aaa aac aag gtg cga tgc agg gga caa Phe Leu Pro Val Ser Gly His Lys Asn Lys Val Arg Cys Arg Gly Gln 355 360 365	1104
att tca ccg cat aaa ggc aag ctt gtc tac gtc atg gaa atc aaa aag Ile Ser Pro His Lys Gly Lys Leu Val Tyr Val Met Glu Ile Lys Lys 370 375 380	1152
atg ggt tac gat caa gca tct gga agc cca tac gcc atc gcg gac gtt Met Gly Tyr Asp Gln Ala Ser Gly Ser Pro Tyr Ala Ile Ala Asp Val 385 390 395 400	1200
gat atc att gac gtc aac gaa gag ctg ggt caa agt ttt gac atc aac Asp Ile Ile Asp Val Asn Glu Glu Leu Gly Gln Ser Phe Asp Ile Asn 405 410 415	1248
gac ctt gcg agc tac gga aaa ggt gac ctg agc aaa aaa atc gtg gtt Asp Leu Ala Ser Tyr Gly Lys Gly Asp Leu Ser Lys Lys Ile Val Val 420 425 430	1296
gac ttc aaa gga att gct ttg cag ctc aaa ggc cgc gct ttt tca cgc Asp Phe Lys Gly Ile Ala Leu Gln Leu Lys Gly Arg Ala Phe Ser Arg 435 440 445	1344
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ctt cct ggc aac cct acg ccg ttc ttc tcc cct tca tct tac cct ccg Leu Pro Gly Asn Pro Thr Pro Phe Phe Ser Pro Ser Ser Tyr Pro Pro 500 505 510	1536
agg gca att tgc ttc atc cct ttc ccg ggc aat ccc ctt gac aac aac Arg Ala Ile Cys Phe Ile Pro Phe Pro Gly Asn Pro Leu Asp Asn Asn 515 520 525	1584

tgc aag gct gga gaa atg ccc ctg aac tgg tac aac atg tca gag ttc Cys Lys Ala Gly Glu Met Pro Leu Asn Trp Tyr Asn Met Ser Glu Phe 530 535 540	1632
atg tgt ggc aag gtt tct aac tgc ttg ggc cca gaa ttc gca cgc ttt Met Cys Gly Lys Val Ser Asn Cys Leu Gly Pro Glu Phe Ala Arg Phe 545 550 555 560	1680
gac aag tgc aac acc agc cgg agc cct gct ttt gac ttg gct ctg gtg Asp Lys Ser Asn Thr Ser Arg Ser Pro Ala Phe Asp Leu Ala Leu Val 565 570 575	1728
acc cga gtt gtt gaa gtc aca aac atg gaa cac ggc aag ttt cta aac Thr Arg Val Val Glu Val Thr Asn Met Glu His Gly Lys Phe Leu Asn 580 585 590	1776
gtt gat tgc aat cca agc aaa ggc aca atg gtg ggg gag ttt gac tgt Val Asp Cys Asn Pro Ser Lys Gly Thr Met Val Gly Glu Phe Asp Cys 595 600 605	1824
ccc caa gac gcg tgg ttc ttt gat ggt tgc tgc aac gac ggc cat atg Pro Gln Asp Ala Trp Phe Phe Asp Gly Ser Cys Asn Asp Gly His Met 610 615 620	1872
ccg tat tcc att atc atg gaa atc gga ctg caa acc tca ggt gtt ctc Pro Tyr Ser Ile Ile Met Glu Ile Gly Leu Gln Thr Ser Gly Val Leu 625 630 635 640	1920
acc tgc gtg ttg aag gca ccg ctg act atg gac aag gat gac att ctc Thr Ser Val Leu Lys Ala Pro Leu Thr Met Asp Lys Asp Asp Ile Leu 645 650 655	1968
ttt cga aac ctc gat gca agt gct gaa atg gtg cgt cca gac gtg gat Phe Arg Asn Leu Asp Ala Ser Ala Glu Met Val Arg Pro Asp Val Asp 660 665 670	2016
gtt cgc ggc aaa acg att cga aac gtg acc aag tgt acc ggc tat gca Val Arg Gly Lys Thr Ile Arg Asn Val Thr Lys Cys Thr Gly Tyr Ala 675 680 685	2064
atg ttg gga aag atg ggg att cac cgg ttc acg ttt gag ttg agc gtt Met Leu Gly Lys Met Gly Ile His Arg Phe Thr Phe Glu Leu Ser Val 690 695 700	2112
gac ggc gtg gta ttt tat aaa gga tcc act tcc ttt gga tgg ttc act Asp Gly Val Val Phe Tyr Lys Gly Ser Thr Ser Phe Gly Trp Phe Thr 705 710 715 720	2160
ccc gag gtg ttt gct cag caa gct gga ctc gac aac ggg aaa aag acg Pro Glu Val Phe Ala Gln Gln Ala Gly Leu Asp Asn Gly Lys Lys Thr 725 730 735	2208
gag ccc tgg tgc aag act aac aac acc tgc gtt cga aga gtt gaa atc Glu Pro Trp Cys Lys Thr Asn Asn Thr Ser Val Arg Arg Val Glu Ile 740 745 750	2256
gca tcc gcc aaa gga aaa gag cag ctg act gag aag ctt ccc gac gca Ala Ser Ala Lys Gly Lys Glu Gln Leu Thr Glu Lys Leu Pro Asp Ala 755 760 765	2304
act aat gct caa gtt ctt cgg cgt tca gag cag tgt gaa tac ctc gat Thr Asn Ala Gln Val Leu Arg Arg Ser Glu Gln Cys Glu Tyr Leu Asp 770 775 780	2352
tac ctc aat att gcc cct gac tct ggg ctg cat ggg aag ggc tac gcc Tyr Leu Asn Ile Ala Pro Asp Ser Gly Leu His Gly Lys Gly Tyr Ala 785 790 795 800	2400

cac gga cac aaa gac gtt aac ccg caa gac tgg ttc ttc tct tgc cac His Gly His Lys Asp Val Asn Pro Gln Asp Trp Phe Phe Ser Cys His 805 810 815	2448
ttt tgg ttc gat cct gta atg cca gga tct tta gga att gaa tca atg Phe Trp Phe Asp Pro Val Met Pro Gly Ser Leu Gly Ile Glu Ser Met 820 825 830	2496
ttc cag ctt atc gag gcc ttt gcg gtg gac caa aac att cct gga gag Phe Gln Leu Ile Glu Ala Phe Ala Val Asp Gln Asn Ile Pro Gly Glu 835 840 845	2544
tac aac gta tcc aat ccg acc ttt gcc cat gca cca ggc aaa acg gcg Tyr Asn Val Ser Asn Pro Thr Phe Ala His Ala Pro Gly Lys Thr Ala 850 855 860	2592
tgg aaa tac cga ggc cag ctc aca cca aag aac cgt gcg atg gac tgc Trp Lys Tyr Arg Gly Gln Leu Thr Pro Lys Asn Arg Ala Met Asp Cys 865 870 875 880	2640
gag gtg cat atc gtt tca att acc gcc tcc ccc gag aac ggg ggc tac Glu Val His Ile Val Ser Ile Thr Ala Ser Pro Glu Asn Gly Gly Tyr 885 890 895	2688
gtt gac atc gtg gcc gat gga gcg ctt tgg gta gat gga ctt cgc gtg Val Asp Ile Val Ala Asp Gly Ala Leu Trp Val Asp Gly Leu Arg Val 900 905 910	2736
tac gaa gcc aaa gag ctt cga gtt cgt gtc gtt tcg gca aaa cct caa Tyr Glu Ala Lys Glu Leu Arg Val Arg Val Val Ser Ala Lys Pro Gln 915 920 925	2784
gca att ccg gat gta caa caa cag cca cct agc gca aag gcg gac ccg Ala Ile Pro Asp Val Gln Gln Gln Pro Pro Ser Ala Lys Ala Asp Pro 930 935 940	2832
ggg aaa aca gga gtt gca ctt tcg ccc act cag cta cgc gac gtc ctg Gly Lys Thr Gly Val Ala Leu Ser Pro Thr Gln Leu Arg Asp Val Leu 945 950 955 960	2880
ctt gaa gtg gac aat cca ttg tat ctt ggt gta gag aac tcc aat ttg Leu Glu Val Asp Asn Pro Leu Tyr Leu Gly Val Glu Asn Ser Asn Leu 965 970 975	2928
gtg cag ttt gag tcg aaa cct gca act tct tca cgt atc gtt tcg atc Val Gln Phe Glu Ser Lys Pro Ala Thr Ser Ser Arg Ile Val Ser Ile 980 985 990	2976
aaa ccg tgc tcg att agt gac ctt ggc gat aag tct ttt atg gaa acg Lys Pro Cys Ser Ile Ser Asp Leu Gly Asp Lys Ser Phe Met Glu Thr 995 1000 1005	3024
tac aac gtg tca gca cct ctg tat act gga gca atg gcc aag ggc Tyr Asn Val Ser Ala Pro Leu Tyr Thr Gly Ala Met Ala Lys Gly 1010 1015 1020	3069
att gca tcc gcc gac ttg gtc att gct gct ggg aaa cgc aag ata Ile Ala Ser Ala Asp Leu Val Ile Ala Ala Gly Lys Arg Lys Ile 1025 1030 1035	3114
ctt gga tcg ttt ggt gcg gga ggg ctg cct att tcc ata gtc cgt Leu Gly Ser Phe Gly Ala Gly Gly Leu Pro Ile Ser Ile Val Arg 1040 1045 1050	3159
gaa gca ctg gag aaa att caa caa cac ctg ccc cac ggc ccg tac Glu Ala Leu Glu Lys Ile Gln Gln His Leu Pro His Gly Pro Tyr 1055 1060 1065	3204

gct gtt aac ctc att cac tcg cct ttc gac agc aac ttg gaa aag Ala Val Asn Leu Ile His Ser Pro Phe Asp Ser Asn Leu Glu Lys 1070 1075 1080	3249
ggc aac gtt gac ctc ttt ctc gag atg ggc gtg aca gtg gta gaa Gly Asn Val Asp Leu Phe Leu Glu Met Gly Val Thr Val Val Glu 1085 1090 1095	3294
tgc agc gcg ttc atg gaa ctc acg gcc cag gtt gtc cgg tac cgc Cys Ser Ala Phe Met Glu Leu Thr Ala Gln Val Val Arg Tyr Arg 1100 1105 1110	3339
gcg tct ggt cta agc aaa agt gcg gac ggt tcg att cgc att gct Ala Ser Gly Leu Ser Lys Ser Ala Asp Gly Ser Ile Arg Ile Ala 1115 1120 1125	3384
cac cgt att att ggc aag gtt tcc aga acc gag ctg gca gaa atg His Arg Ile Ile Gly Lys Val Ser Arg Thr Glu Leu Ala Glu Met 1130 1135 1140	3429
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tcc ggc gag ctg aca gct gag caa gcc gag ctt gca aca cag gtt Ser Gly Glu Leu Thr Ala Glu Gln Ala Glu Leu Ala Thr Gln Val 1160 1165 1170	3519
ccg gtg gcg gat gac att gcg gtc gaa gcc gac tcg ggg ggg cat Pro Val Ala Asp Asp Ile Ala Val Glu Ala Asp Ser Gly Gly His 1175 1180 1185	3564
acc gac aac agg cct att cac gtc att ctt cct cta atc atc aac Thr Asp Asn Arg Pro Ile His Val Ile Leu Pro Leu Ile Ile Asn 1190 1195 1200	3609
cta cgc aac cgt ttg cat aaa gag ctt gac tac cct tcg cat ctc Leu Arg Asn Arg Leu His Lys Glu Leu Asp Tyr Pro Ser His Leu 1205 1210 1215	3654
cgg gta cgt gtg ggt gct ggt ggt ggt att gga tgt cct caa gcc Arg Val Arg Val Gly Ala Gly Gly Gly Ile Gly Cys Pro Gln Ala 1220 1225 1230	3699
gct ctt gca gca ttt caa atg ggg gca gcg ttt tta atc act gga Ala Leu Ala Ala Phe Gln Met Gly Ala Ala Phe Leu Ile Thr Gly 1235 1240 1245	3744
acg gtg aac cag ctt gct cgt gaa agt ggc act tgt gac aac gtc Thr Val Asn Gln Leu Ala Arg Glu Ser Gly Thr Cys Asp Asn Val 1250 1255 1260	3789
cgg tta cag ctc tca aag gcc acg tat agc gac gtg tgt atg gct Arg Leu Gln Leu Ser Lys Ala Thr Tyr Ser Asp Val Cys Met Ala 1265 1270 1275	3834
cct gct gcc gat atg ttt gac caa ggc gtg gag ctg caa gta ttg Pro Ala Ala Asp Met Phe Asp Gln Gly Val Glu Leu Gln Val Leu 1280 1285 1290	3879
aag aaa ggc acg ctg ttc cca agt cgt gct aag aag ctg tac gag Lys Lys Gly Thr Leu Phe Pro Ser Arg Ala Lys Lys Leu Tyr Glu 1295 1300 1305	3924
ctg ttc tgc aag tat gac tcg ttt gag gca atg ccg gct gaa gaa Leu Phe Cys Lys Tyr Asp Ser Phe Glu Ala Met Pro Ala Glu Glu 1310 1315 1320	3969

ttg caa cgg gtt gaa aag cgg att ttt caa aag tcg ctt gct gaa	4014
Leu Gln Arg Val Glu Lys Arg Ile Phe Gln Lys Ser Leu Ala Glu	
1325 1330 1335	
gtt tgg cag gag acc agt gac ttt tac att cat cgt atc aag aac	4059
Val Trp Gln Glu Thr Ser Asp Phe Tyr Ile His Arg Ile Lys Asn	
1340 1345 1350	
cct gag aaa atc aat cgt gct gca agc gat ggc aaa ctg aaa atg	4104
Pro Glu Lys Ile Asn Arg Ala Ala Ser Asp Gly Lys Leu Lys Met	
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tcg ctt tgc ttt cgc tgg tac ctt ggg ctt tcc tca ttt tgg gcc	4149
Ser Leu Cys Phe Arg Trp Tyr Leu Gly Leu Ser Ser Phe Trp Ala	
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aac tct ggg gca caa gat cgc gtc atg gac tat caa att tgg tgt	4194
Asn Ser Gly Ala Gln Asp Arg Val Met Asp Tyr Gln Ile Trp Cys	
1385 1390 1395	
ggc cct gct att ggc gct ttc aat gat ttt acc aag ggc acg tac	4239
Gly Pro Ala Ile Gly Ala Phe Asn Asp Phe Thr Lys Gly Thr Tyr	
1400 1405 1410	
ctt gac gtg act gtt gca aag agt tac cct tgt gtg gca cag atc	4284
Leu Asp Val Thr Val Ala Lys Ser Tyr Pro Cys Val Ala Gln Ile	
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Asn Leu Gln Ile Leu Gln Gly Ala Ala Tyr Leu Lys Arg Leu Gly	
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gtc att cgt ttt gac cgc atg ctg ctg cag gcc gtc gat atc gac	4374
Val Ile Arg Phe Asp Arg Met Leu Leu Gln Ala Val Asp Ile Asp	
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<400> 62

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Leu Leu Glu Phe Ala Glu Gly Asp Ile Ser Lys Val Phe Gly Pro Glu
35 40 45

Phe Lys Val Val Asp Gly Phe Arg Arg Arg Val Arg Leu Pro Ala Arg
50 55 60

Glu Tyr Leu Leu Val Thr Arg Val Thr Leu Met Asp Ala Glu Val Gly
65 70 75 80

Asn Phe Arg Val Gly Ala Arg Met Val Thr Glu Tyr Asp Val Pro Val  
                     85                    90                    95

Asn Gly Glu Leu Ser Glu Gly Gly Asp Val Pro Trp Ala Val Leu Val  
                     100                    105                    110

Glu Ala Gly Gln Cys Asp Leu Leu Leu Ile Ser Tyr Met Gly Ile Asp  
                     115                    120                    125

Phe Gln Cys Lys Gly Glu Arg Val Tyr Arg Leu Leu Asn Thr Thr Leu  
                     130                    135                    140

Thr Phe Phe Gly Val Ala Lys Glu Gly Glu Thr Leu Val Tyr Asp Ile  
                     145                    150                    155                    160

Arg Val Thr Gly Phe Ala Lys Arg Pro Asp Gly Asp Ile Ser Met Phe  
                     165                    170                    175

Phe Phe Glu Tyr Asp Cys Tyr Cys Asn Gly Lys Leu Leu Ile Glu Met  
                     180                    185                    190

Arg Asp Gly Ser Ala Gly Phe Phe Thr Asp Glu Glu Leu Ala Ala Gly  
                     195                    200                    205

Lys Gly Val Val Val Thr Arg Ala Gln Gln Asn Met Arg Asp Lys Ile  
                     210                    215                    220

Val Arg Gln Ser Ile Glu Pro Phe Ala Leu Ala Ala Cys Thr His Lys  
                     225                    230                    235                    240

Thr Thr Leu Asn Glu Ser Asp Met Gln Ser Leu Val Glu Arg Asn Trp  
                     245                    250                    255

Ala Asn Val Phe Gly Thr Ser Asn Lys Met Ala Glu Leu Asn Tyr Lys  
                     260                    265                    270

Ile Cys Ala Arg Lys Met Leu Met Ile Asp Arg Val Thr His Ile Asp  
                     275                    280                    285

His His Gly Gly Ala Tyr Gly Leu Gly Leu Leu Val Gly Glu Lys Ile  
                     290                    295                    300

Leu Asp Arg Asn His Trp Tyr Phe Pro Cys His Phe Val Asn Asp Gln  
                     305                    310                    315                    320

Val Met Ala Gly Ser Leu Val Ser Asp Gly Cys Ser Gln Leu Leu Lys  
                     325                    330                    335

Leu Tyr Met Ile Trp Leu Gly Leu His Leu Lys Met Glu Glu Phe Asp  
                     340                    345                    350



Phe Leu Pro Val Ser Gly His Lys Asn Lys Val Arg Cys Arg Gly Gln  
 355 360 365  
 Ile Ser Pro His Lys Gly Lys Leu Val Tyr Val Met Glu Ile Lys Lys  
 370 375 380  
 Met Gly Tyr Asp Gln Ala Ser Gly Ser Pro Tyr Ala Ile Ala Asp Val  
 385 390 395 400  
 Asp Ile Ile Asp Val Asn Glu Glu Leu Gly Gln Ser Phe Asp Ile Asn  
 405 410 415  
 Asp Leu Ala Ser Tyr Gly Lys Gly Asp Leu Ser Lys Lys Ile Val Val  
 420 425 430  
 Asp Phe Lys Gly Ile Ala Leu Gln Leu Lys Gly Arg Ala Phe Ser Arg  
 435 440 445  
 Met Ser Ser Ser Ser Ser Leu Asn Glu Gly Trp Gln Cys Val Pro Lys  
 450 455 460  
 Pro Ser Gln Arg Met Glu His Glu Gln Pro Pro Ala His Cys Leu Ala  
 465 470 475 480  
 Ser Asp Pro Glu Ala Pro Ser Thr Val Thr Trp His Pro Met Ser Lys  
 485 490 495  
 Leu Pro Gly Asn Pro Thr Pro Phe Phe Ser Pro Ser Ser Tyr Pro Pro  
 500 505 510  
 Arg Ala Ile Cys Phe Ile Pro Phe Pro Gly Asn Pro Leu Asp Asn Asn  
 515 520 525  
 Cys Lys Ala Gly Glu Met Pro Leu Asn Trp Tyr Asn Met Ser Glu Phe  
 530 535 540  
 Met Cys Gly Lys Val Ser Asn Cys Leu Gly Pro Glu Phe Ala Arg Phe  
 545 550 555 560  
 Asp Lys Ser Asn Thr Ser Arg Ser Pro Ala Phe Asp Leu Ala Leu Val  
 565 570 575  
 Thr Arg Val Val Glu Val Thr Asn Met Glu His Gly Lys Phe Leu Asn  
 580 585 590  
 Val Asp Cys Asn Pro Ser Lys Gly Thr Met Val Gly Glu Phe Asp Cys  
 595 600 605  
 Pro Gln Asp Ala Trp Phe Phe Asp Gly Ser Cys Asn Asp Gly His Met  
 610 615 620

Pro Tyr Ser Ile Ile Met Glu Ile Gly Leu Gln Thr Ser Gly Val Leu  
 625 630 635 640

Thr Ser Val Leu Lys Ala Pro Leu Thr Met Asp Lys Asp Asp Ile Leu  
 645 650 655

Phe Arg Asn Leu Asp Ala Ser Ala Glu Met Val Arg Pro Asp Val Asp  
 660 665 670

Val Arg Gly Lys Thr Ile Arg Asn Val Thr Lys Cys Thr Gly Tyr Ala  
 675 680 685

Met Leu Gly Lys Met Gly Ile His Arg Phe Thr Phe Glu Leu Ser Val  
 690 695 700

Asp Gly Val Val Phe Tyr Lys Gly Ser Thr Ser Phe Gly Trp Phe Thr  
 705 710 715 720

Pro Glu Val Phe Ala Gln Gln Ala Gly Leu Asp Asn Gly Lys Lys Thr  
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Glu Pro Trp Cys Lys Thr Asn Asn Thr Ser Val Arg Arg Val Glu Ile  
 740 745 750

Ala Ser Ala Lys Gly Lys Glu Gln Leu Thr Glu Lys Leu Pro Asp Ala  
 755 760 765

Thr Asn Ala Gln Val Leu Arg Arg Ser Glu Gln Cys Glu Tyr Leu Asp  
 770 775 780

Tyr Leu Asn Ile Ala Pro Asp Ser Gly Leu His Gly Lys Gly Tyr Ala  
 785 790 795 800

His Gly His Lys Asp Val Asn Pro Gln Asp Trp Phe Phe Ser Cys His  
 805 810 815

Phe Trp Phe Asp Pro Val Met Pro Gly Ser Leu Gly Ile Glu Ser Met  
 820 825 830

Phe Gln Leu Ile Glu Ala Phe Ala Val Asp Gln Asn Ile Pro Gly Glu  
 835 840 845

Tyr Asn Val Ser Asn Pro Thr Phe Ala His Ala Pro Gly Lys Thr Ala  
 850 855 860

Trp Lys Tyr Arg Gly Gln Leu Thr Pro Lys Asn Arg Ala Met Asp Cys  
 865 870 875 880

Glu Val His Ile Val Ser Ile Thr Ala Ser Pro Glu Asn Gly Gly Tyr  
 885 890 895

Val Asp Ile Val Ala Asp Gly Ala Leu Trp Val Asp Gly Leu Arg Val  
 900 905 910

Tyr Glu Ala Lys Glu Leu Arg Val Arg Val Val Ser Ala Lys Pro Gln  
 915 920 925

Ala Ile Pro Asp Val Gln Gln Gln Pro Pro Ser Ala Lys Ala Asp Pro  
 930 935 940

Gly Lys Thr Gly Val Ala Leu Ser Pro Thr Gln Leu Arg Asp Val Leu  
 945 950 955 960

Leu Glu Val Asp Asn Pro Leu Tyr Leu Gly Val Glu Asn Ser Asn Leu  
 965 970 975

Val Gln Phe Glu Ser Lys Pro Ala Thr Ser Ser Arg Ile Val Ser Ile  
 980 985 990

Lys Pro Cys Ser Ile Ser Asp Leu Gly Asp Lys Ser Phe Met Glu Thr  
 995 1000 1005

Tyr Asn Val Ser Ala Pro Leu Tyr Thr Gly Ala Met Ala Lys Gly  
 1010 1015 1020

Ile Ala Ser Ala Asp Leu Val Ile Ala Ala Gly Lys Arg Lys Ile  
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Leu Gly Ser Phe Gly Ala Gly Gly Leu Pro Ile Ser Ile Val Arg  
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Glu Ala Leu Glu Lys Ile Gln Gln His Leu Pro His Gly Pro Tyr  
 1055 1060 1065

Ala Val Asn Leu Ile His Ser Pro Phe Asp Ser Asn Leu Glu Lys  
 1070 1075 1080

Gly Asn Val Asp Leu Phe Leu Glu Met Gly Val Thr Val Val Glu  
 1085 1090 1095

Cys Ser Ala Phe Met Glu Leu Thr Ala Gln Val Val Arg Tyr Arg  
 1100 1105 1110

Ala Ser Gly Leu Ser Lys Ser Ala Asp Gly Ser Ile Arg Ile Ala  
 1115 1120 1125

His Arg Ile Ile Gly Lys Val Ser Arg Thr Glu Leu Ala Glu Met  
 1130 1135 1140

Phe Ile Arg Pro Ala Pro Gln His Leu Leu Gln Lys Leu Val Ala  
 1145 1150 1155

Ser	Gly	Glu	Leu	Thr	Ala	Glu	Gln	Ala	Glu	Leu	Ala	Thr	Gln	Val
1160						1165					1170			
Pro	Val	Ala	Asp	Asp	Ile	Ala	Val	Glu	Ala	Asp	Ser	Gly	Gly	His
1175						1180					1185			
Thr	Asp	Asn	Arg	Pro	Ile	His	Val	Ile	Leu	Pro	Leu	Ile	Ile	Asn
1190						1195					1200			
Leu	Arg	Asn	Arg	Leu	His	Lys	Glu	Leu	Asp	Tyr	Pro	Ser	His	Leu
1205						1210					1215			
Arg	Val	Arg	Val	Gly	Ala	Gly	Gly	Gly	Ile	Gly	Cys	Pro	Gln	Ala
1220						1225					1230			
Ala	Leu	Ala	Ala	Phe	Gln	Met	Gly	Ala	Ala	Phe	Leu	Ile	Thr	Gly
1235						1240					1245			
Thr	Val	Asn	Gln	Leu	Ala	Arg	Glu	Ser	Gly	Thr	Cys	Asp	Asn	Val
1250						1255					1260			
Arg	Leu	Gln	Leu	Ser	Lys	Ala	Thr	Tyr	Ser	Asp	Val	Cys	Met	Ala
1265						1270					1275			
Pro	Ala	Ala	Asp	Met	Phe	Asp	Gln	Gly	Val	Glu	Leu	Gln	Val	Leu
1280						1285					1290			
Lys	Lys	Gly	Thr	Leu	Phe	Pro	Ser	Arg	Ala	Lys	Lys	Leu	Tyr	Glu
1295						1300					1305			
Leu	Phe	Cys	Lys	Tyr	Asp	Ser	Phe	Glu	Ala	Met	Pro	Ala	Glu	Glu
1310						1315					1320			
Leu	Gln	Arg	Val	Glu	Lys	Arg	Ile	Phe	Gln	Lys	Ser	Leu	Ala	Glu
1325						1330					1335			
Val	Trp	Gln	Glu	Thr	Ser	Asp	Phe	Tyr	Ile	His	Arg	Ile	Lys	Asn
1340						1345					1350			
Pro	Glu	Lys	Ile	Asn	Arg	Ala	Ala	Ser	Asp	Gly	Lys	Leu	Lys	Met
1355						1360					1365			
Ser	Leu	Cys	Phe	Arg	Trp	Tyr	Leu	Gly	Leu	Ser	Ser	Phe	Trp	Ala
1370						1375					1380			
Asn	Ser	Gly	Ala	Gln	Asp	Arg	Val	Met	Asp	Tyr	Gln	Ile	Trp	Cys
1385						1390					1395			
Gly	Pro	Ala	Ile	Gly	Ala	Phe	Asn	Asp	Phe	Thr	Lys	Gly	Thr	Tyr
1400						1405					1410			

Leu Asp Val Thr Val Ala Lys Ser Tyr Pro Cys Val Ala Gln Ile  
 1415 1420 1425

Asn Leu Gln Ile Leu Gln Gly Ala Ala Tyr Leu Lys Arg Leu Gly  
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 Lys Ser Glu Leu Cys Asp Asp Arg Thr Val Val Phe Asp Tyr Glu Glu  
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 ctg ctg gag ttc gct gag ggc gat atc agt aag gtt ttt ggg ccg gag 144  
 Leu Leu Glu Phe Ala Glu Gly Asp Ile Ser Lys Val Phe Gly Pro Glu  
 35 40 45  
 ttc aaa gtg gtg gac ggg ttt agg cgc agg gtg agg ttg ccc gct cga 192  
 Phe Lys Val Val Asp Gly Phe Arg Arg Arg Val Arg Leu Pro Ala Arg  
 50 55 60  
 gag tac ctg ctg gtg acc cgg gtt acg ctg atg gat gcc gag gtg ggc 240  
 Glu Tyr Leu Leu Val Thr Arg Val Thr Leu Met Asp Ala Glu Val Gly  
 65 70 75 80  
 aac ttt cga gtg gga gca cgt atg gtg aca gag tat gac gta cct gtg 288  
 Asn Phe Arg Val Gly Ala Arg Met Val Thr Glu Tyr Asp Val Pro Val  
 85 90 95  
 aac gga gag ctc tcg gaa ggg gga gat gtg ccg tgg gct gtg ttg gtg 336  
 Asn Gly Glu Leu Ser Glu Gly Gly Asp Val Pro Trp Ala Val Leu Val  
 100 105 110  
 gaa gcc ggg cag tgc gac ttg ctg cta att tct tac atg ggc atc gat 384  
 Glu Ala Gly Gln Cys Asp Leu Leu Leu Ile Ser Tyr Met Gly Ile Asp  
 115 120 125  
 ttc cag tgc aaa gga gag cgg gtc tac cgg ctg ctg aac acc acc ttg 432  
 Phe Gln Cys Lys Gly Glu Arg Val Tyr Arg Leu Leu Asn Thr Thr Leu  
 130 135 140  
 acg ttt ttt ggc gtc gcg aaa gaa ggg gaa acg ctt gtg tac gat att 480  
 Thr Phe Phe Gly Val Ala Lys Glu Gly Glu Thr Leu Val Tyr Asp Ile  
 145 150 155 160  
 cgc gtc acg ggt ttc gcc aag agg ccg gac gga gat atc tcc atg ttc 528

Arg	Val	Thr	Gly	Phe	Ala	Lys	Arg	Pro	Asp	Gly	Asp	Ile	Ser	Met	Phe		
				165					170					175			
ttt	ttc	gaa	tat	gat	tgc	tac	tgc	aat	ggc	aag	ctt	ctc	atc	gaa	atg	576	
Phe	Phe	Glu	Tyr	Asp	Cys	Tyr	Cys	Asn	Gly	Lys	Leu	Leu	Ile	Glu	Met		
			180					185					190				
cga	gat	ggc	tct	gca	ggc	ttc	ttc	acg	gac	gaa	gag	ctc	gct	gcc	ggc	624	
Arg	Asp	Gly	Ser	Ala	Gly	Phe	Phe	Thr	Asp	Glu	Glu	Leu	Ala	Ala	Gly		
			195				200					205					
aaa	gga	gtg	gtc	gtc	act	cgt	gca	cag	caa	aac	atg	cgg	gac	aaa	att	672	
Lys	Gly	Val	Val	Val	Thr	Arg	Ala	Gln	Gln	Asn	Met	Arg	Asp	Lys	Ile		
		210				215					220						
gta	cgg	cag	tcc	att	gag	cct	ttt	gca	ctg	gcg	gct	tgc	acg	cac	aaa	720	
Val	Arg	Gln	Ser	Ile	Glu	Pro	Phe	Ala	Leu	Ala	Ala	Cys	Thr	His	Lys		
225					230					235					240		
acg	act	ctg	aac	gag	agt	gac	atg	cag	tcc	ctt	gtg	gag	cga	aac	tgg	768	
Thr	Thr	Leu	Asn	Glu	Ser	Asp	Met	Gln	Ser	Leu	Val	Glu	Arg	Asn	Trp		
				245				250						255			
gca	aac	gtt	ttt	ggc	acc	agt	aac	aag	atg	gcg	gag	ctc	aac	tat	aaa	816	
Ala	Asn	Val	Phe	Gly	Thr	Ser	Asn	Lys	Met	Ala	Glu	Leu	Asn	Tyr	Lys		
			260					265					270				
att	tgc	gcc	agg	aaa	atg	ctc	atg	atc	gac	agg	gtt	acc	cac	att	gac	864	
Ile	Cys	Ala	Arg	Lys	Met	Leu	Met	Ile	Asp	Arg	Val	Thr	His	Ile	Asp		
		275					280					285					
cac	cac	ggt	ggg	gcg	tat	ggc	ctc	gga	cta	ctt	gtt	gga	gag	aag	atc	912	
His	His	Gly	Gly	Ala	Tyr	Gly	Leu	Gly	Leu	Leu	Val	Gly	Glu	Lys	Ile		
		290				295					300						
ttg	gat	cga	aac	cat	tgg	tac	ttt	cct	tgt	cac	ttt	gtc	aat	gat	caa	960	
Leu	Asp	Arg	Asn	His	Trp	Tyr	Phe	Pro	Cys	His	Phe	Val	Asn	Asp	Gln		
305					310					315					320		
gtc	atg	gca	ggg	tca	ctg	gtc	agc	gat	ggc	tgc	agc	cag	ctc	tta	aaa	1008	
Val	Met	Ala	Gly	Ser	Leu	Val	Ser	Asp	Gly	Cys	Ser	Gln	Leu	Leu	Lys		
				325					330					335			
ctc	tat	atg	atc	tgg	ctt	ggc	ctc	cac	ctg	aaa	atg	gag	gaa	ttt	gat	1056	
Leu	Tyr	Met	Ile	Trp	Leu	Gly	Leu	His	Leu	Lys	Met	Glu	Glu	Phe	Asp		
				340				345					350				
ttt	ctc	cca	gtt	agc	ggc	cac	aaa	aac	aag	gtg	cga	tgc	agg	gga	caa	1104	
Phe	Leu	Pro	Val	Ser	Gly	His	Lys	Asn	Lys	Val	Arg	Cys	Arg	Gly	Gln		
		355					360					365					
att	tca	ccg	cat	aaa	ggc	aag	ctt	gtc	tac	gtc	atg	gaa	atc	aaa	aag	1152	
Ile	Ser	Pro	His	Lys	Gly	Lys	Leu	Val	Tyr	Val	Met	Glu	Ile	Lys	Lys		
		370				375					380						
atg	ggt	tac	gat	caa	gca	tct	gga	agc	cca	tac	gcc	atc	gcg	gac	gtt	1200	
Met	Gly	Tyr	Asp	Gln	Ala	Ser	Gly	Ser	Pro	Tyr	Ala	Ile	Ala	Asp	Val		
					390					395					400		
gat	atc	att	gac	gtc	aac	gaa	gag	ctg	ggc	caa	agt	ttt	gac	atc	aac	1248	
Asp	Ile	Ile	Asp	Val	Asn	Glu	Glu	Leu	Gly	Gln	Ser	Phe	Asp	Ile	Asn		
				405					410				415				
gac	ctt	gcg	agc	tac	gga	aaa	ggc	gac	ctg	agc	aaa	aaa	atc	gtg	gtt	1296	
Asp	Leu	Ala	Ser	Tyr	Gly	Lys	Gly	Asp	Leu	Ser	Lys	Lys	Ile	Val	Val		
				420				425					430				
gac	ttc	aaa	gga	att	gct	ttg	cag	ctc	aaa	ggc	cgc	gct	ttt	tca	cgc	1344	

Asp Phe Lys Gly Ile Ala Leu Gln Leu Lys Gly Arg Ala Phe Ser Arg  
 435 440 445  
 atg agt tcc agc tcg tcc ttg aac gaa gga tgg caa tgt gtt cca aaa 1392  
 Met Ser Ser Ser Ser Ser Leu Asn Glu Gly Trp Gln Cys Val Pro Lys  
 450 455 460  
 cca agc cag aga atg gaa cac gaa cag ccc cct gct cac tgc ctt gca 1440  
 Pro Ser Gln Arg Met Glu His Glu Gln Pro Pro Ala His Cys Leu Ala  
 465 470 475 480  
 agc gac ccc gaa gcc cct tca act gtg acc tgg cac cca atg tca aag 1488  
 Ser Asp Pro Glu Ala Pro Ser Thr Val Thr Trp His Pro Met Ser Lys  
 485 490 495  
 ctt cct ggc aac 1500  
 Leu Pro Gly Asn  
 500

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 <211> 500  
 <212> PRT  
 <213> Thraustochytrium sp.

<400> 64

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 Lys Ser Glu Leu Cys Asp Asp Arg Thr Val Val Phe Asp Tyr Glu Glu  
 20 25 30  
 Leu Leu Glu Phe Ala Glu Gly Asp Ile Ser Lys Val Phe Gly Pro Glu  
 35 40 45  
 Phe Lys Val Val Asp Gly Phe Arg Arg Arg Val Arg Leu Pro Ala Arg  
 50 55 60  
 Glu Tyr Leu Leu Val Thr Arg Val Thr Leu Met Asp Ala Glu Val Gly  
 65 70 75 80  
 Asn Phe Arg Val Gly Ala Arg Met Val Thr Glu Tyr Asp Val Pro Val  
 85 90 95  
 Asn Gly Glu Leu Ser Glu Gly Gly Asp Val Pro Trp Ala Val Leu Val  
 100 105 110  
 Glu Ala Gly Gln Cys Asp Leu Leu Leu Ile Ser Tyr Met Gly Ile Asp  
 115 120 125  
 Phe Gln Cys Lys Gly Glu Arg Val Tyr Arg Leu Leu Asn Thr Thr Leu  
 130 135 140  
 Thr Phe Phe Gly Val Ala Lys Glu Gly Glu Thr Leu Val Tyr Asp Ile  
 145 150 155 160  
 Arg Val Thr Gly Phe Ala Lys Arg Pro Asp Gly Asp Ile Ser Met Phe

				165						170						175
Phe	Phe	Glu	Tyr	Asp	Cys	Tyr	Cys	Asn	Gly	Lys	Leu	Leu	Ile	Glu	Met	
			180					185						190		
Arg	Asp	Gly	Ser	Ala	Gly	Phe	Phe	Thr	Asp	Glu	Glu	Leu	Ala	Ala	Gly	
		195					200					205				
Lys	Gly	Val	Val	Val	Thr	Arg	Ala	Gln	Gln	Asn	Met	Arg	Asp	Lys	Ile	
	210					215					220					
Val	Arg	Gln	Ser	Ile	Glu	Pro	Phe	Ala	Leu	Ala	Ala	Cys	Thr	His	Lys	
225					230					235					240	
Thr	Thr	Leu	Asn	Glu	Ser	Asp	Met	Gln	Ser	Leu	Val	Glu	Arg	Asn	Trp	
			245						250					255		
Ala	Asn	Val	Phe	Gly	Thr	Ser	Asn	Lys	Met	Ala	Glu	Leu	Asn	Tyr	Lys	
			260					265						270		
Ile	Cys	Ala	Arg	Lys	Met	Leu	Met	Ile	Asp	Arg	Val	Thr	His	Ile	Asp	
		275					280					285				
His	His	Gly	Gly	Ala	Tyr	Gly	Leu	Gly	Leu	Leu	Val	Gly	Glu	Lys	Ile	
	290					295					300					
Leu	Asp	Arg	Asn	His	Trp	Tyr	Phe	Pro	Cys	His	Phe	Val	Asn	Asp	Gln	
305					310					315					320	
Val	Met	Ala	Gly	Ser	Leu	Val	Ser	Asp	Gly	Cys	Ser	Gln	Leu	Leu	Lys	
				325					330					335		
Leu	Tyr	Met	Ile	Trp	Leu	Gly	Leu	His	Leu	Lys	Met	Glu	Glu	Phe	Asp	
			340					345					350			
Phe	Leu	Pro	Val	Ser	Gly	His	Lys	Asn	Lys	Val	Arg	Cys	Arg	Gly	Gln	
		355					360					365				
Ile	Ser	Pro	His	Lys	Gly	Lys	Leu	Val	Tyr	Val	Met	Glu	Ile	Lys	Lys	
	370					375					380					
Met	Gly	Tyr	Asp	Gln	Ala	Ser	Gly	Ser	Pro	Tyr	Ala	Ile	Ala	Asp	Val	
385					390					395					400	
Asp	Ile	Ile	Asp	Val	Asn	Glu	Glu	Leu	Gly	Gln	Ser	Phe	Asp	Ile	Asn	
				405					410					415		
Asp	Leu	Ala	Ser	Tyr	Gly	Lys	Gly	Asp	Leu	Ser	Lys	Lys	Ile	Val	Val	
			420					425					430			
Asp	Phe	Lys	Gly	Ile	Ala	Leu	Gln	Leu	Lys	Gly	Arg	Ala	Phe	Ser	Arg	



435                      440                      445  
 Met Ser Ser Ser Ser Ser Leu Asn Glu Gly Trp Gln Cys Val Pro Lys  
     450                      455                      460  
  
 Pro Ser Gln Arg Met Glu His Glu Gln Pro Pro Ala His Cys Leu Ala  
 465                      470                      475                      480  
  
 Ser Asp Pro Glu Ala Pro Ser Thr Val Thr Trp His Pro Met Ser Lys  
                     485                      490                      495  
  
 Leu Pro Gly Asn  
                     500  
  
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 <213> Thraustochytrium sp.  
  
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 Pro Thr Pro Phe Phe Ser Pro Ser Ser Tyr Pro Pro Arg Ala Ile Cys  
 1                      5                      10                      15  
  
 ttc atc cct ttc ccg ggc aat ccc ctt gac aac aac tgc aag gct gga 96  
 Phe Ile Pro Phe Pro Gly Asn Pro Leu Asp Asn Asn Cys Lys Ala Gly  
                     20                      25                      30  
  
 gaa atg ccc ctg aac tgg tac aac atg tca gag ttc atg tgt ggc aag 144  
 Glu Met Pro Leu Asn Trp Tyr Asn Met Ser Glu Phe Met Cys Gly Lys  
                     35                      40                      45  
  
 gtt tct aac tgc ttg ggc cca gaa ttc gca cgc ttt gac aag tcg aac 192  
 Val Ser Asn Cys Leu Gly Pro Glu Phe Ala Arg Phe Asp Lys Ser Asn  
                     50                      55                      60  
  
 acc agc ccg agc cct gct ttt gac ttg gct ctg gtg acc cga gtt gtt 240  
 Thr Ser Arg Ser Pro Ala Phe Asp Leu Ala Leu Val Thr Arg Val Val  
 65                      70                      75                      80  
  
 gaa gtc aca aac atg gaa cac ggc aag ttt cta aac gtt gat tgc aat 288  
 Glu Val Thr Asn Met Glu His Gly Lys Phe Leu Asn Val Asp Cys Asn  
                     85                      90                      95  
  
 cca agc aaa ggc aca atg gtg ggg gag ttt gac tgt ccc caa gac gcg 336  
 Pro Ser Lys Gly Thr Met Val Gly Glu Phe Asp Cys Pro Gln Asp Ala  
                     100                      105                      110  
  
 tgg ttc ttt gat ggt tcg tgc aac gac ggc cat atg ccg tat tcc att 384  
 Trp Phe Phe Asp Gly Ser Cys Asn Asp Gly His Met Pro Tyr Ser Ile  
                     115                      120                      125  
  
 atc atg gaa atc gga ctg caa acc tca ggt gtt ctc acc tcg gtg ttg 432  
 Ile Met Glu Ile Gly Leu Gln Thr Ser Gly Val Leu Thr Ser Val Leu  
                     130                      135                      140  
  
 aag gca ccg ctg act atg gac aag gat gac att ctc ttt cga aac ctc 480  
 Lys Ala Pro Leu Thr Met Asp Lys Asp Asp Ile Leu Phe Arg Asn Leu

145		150		155		160	
gat gca agt gct gaa atg gtg cgt cca gac gtg gat gtt cgc ggc aaa							528
Asp Ala Ser Ala Glu Met Val Arg Pro Asp Val Asp Val Arg Gly Lys							
		165		170		175	
acg att cga aac gtg acc aag tgt acc ggc tat gca atg ttg gga aag							576
Thr Ile Arg Asn Val Thr Lys Cys Thr Gly Tyr Ala Met Leu Gly Lys							
		180		185		190	
atg ggg att cac cgg ttc acg ttt gag ttg agc gtt gac ggc gtg gta							624
Met Gly Ile His Arg Phe Thr Phe Glu Leu Ser Val Asp Gly Val Val							
		195		200		205	
ttt tat aaa gga tcc act tcc ttt gga tgg ttc act ccc gag gtg ttt							672
Phe Tyr Lys Gly Ser Thr Ser Phe Gly Trp Phe Thr Pro Glu Val Phe							
		210		215		220	
gct cag caa gct gga ctc gac aac ggg aaa aag acg gag ccc tgg tgc							720
Ala Gln Gln Ala Gly Leu Asp Asn Gly Lys Lys Thr Glu Pro Trp Cys							
		225		230		235	240
aag act aac aac acc tcg gtt cga aga gtt gaa atc gca tcc gcc aaa							768
Lys Thr Asn Asn Thr Ser Val Arg Arg Val Glu Ile Ala Ser Ala Lys							
		245		250		255	
gga aaa gag cag ctg act gag aag ctt ccc gac gca act aat gct caa							816
Gly Lys Glu Gln Leu Thr Glu Lys Leu Pro Asp Ala Thr Asn Ala Gln							
		260		265		270	
gtt ctt cgg cgt tca gag cag tgt gaa tac ctc gat tac ctc aat att							864
Val Leu Arg Arg Ser Glu Gln Cys Glu Tyr Leu Asp Tyr Leu Asn Ile							
		275		280		285	
gcc cct gac tct ggg ctg cat ggg aag ggc tac gcc cac gga cac aaa							912
Ala Pro Asp Ser Gly Leu His Gly Lys Gly Tyr Ala His Gly His Lys							
		290		295		300	
gac gtt aac ccg caa gac tgg ttc ttc tct tgc cac ttt tgg ttc gat							960
Asp Val Asn Pro Gln Asp Trp Phe Phe Ser Cys His Phe Trp Phe Asp							
		305		310		315	320
cct gta atg cca gga tct tta gga att gaa tca atg ttc cag ctt atc							1008
Pro Val Met Pro Gly Ser Leu Gly Ile Glu Ser Met Phe Gln Leu Ile							
		325		330		335	
gag gcc ttt gcg gtg gac caa aac att cct gga gag tac aac gta tcc							1056
Glu Ala Phe Ala Val Asp Gln Asn Ile Pro Gly Glu Tyr Asn Val Ser							
		340		345		350	
aat ccg acc ttt gcc cat gca cca ggc aaa acg gcg tgg aaa tac cga							1104
Asn Pro Thr Phe Ala His Ala Pro Gly Lys Thr Ala Trp Lys Tyr Arg							
		355		360		365	
ggc cag ctc aca cca aag aac cgt gcg atg gac tgc gag gtg cat atc							1152
Gly Gln Leu Thr Pro Lys Asn Arg Ala Met Asp Cys Glu Val His Ile							
		370		375		380	
gtt tca att acc gcc tcc ccc gag aac ggg ggc tac gtt gac atc gtg							1200
Val Ser Ile Thr Ala Ser Pro Glu Asn Gly Gly Tyr Val Asp Ile Val							
		385		390		395	400
gcc gat gga gcg ctt tgg gta gat gga ctt cgc gtg tac gaa gcc aaa							1248
Ala Asp Gly Ala Leu Trp Val Asp Gly Leu Arg Val Tyr Glu Ala Lys							
		405		410		415	
gag ctt cga gtt cgt gtc gtt tcg gca aaa cct caa gca att ccg gat							1296
Glu Leu Arg Val Arg Val Val Ser Ala Lys Pro Gln Ala Ile Pro Asp							

420	425	430	
gta caa caa cag cca cct agc gca aag gcg gac ccg ggg aaa aca gga			1344
Val Gln Gln Gln Pro Pro Ser Ala Lys Ala Asp Pro Gly Lys Thr Gly			
435	440	445	
gtt gca ctt tcg ccc act cag cta cgc gac gtc ctg ctt gaa gtg gac			1392
Val Ala Leu Ser Pro Thr Gln Leu Arg Asp Val Leu Leu Glu Val Asp			
450	455	460	
aat cca ttg tat ctt ggt gta gag aac tcc aat ttg gtg cag ttt gag			1440
Asn Pro Leu Tyr Leu Gly Val Glu Asn Ser Asn Leu Val Gln Phe Glu			
465	470	475	480
tcg aaa cct gca act tct tca cgt atc gtt tcg atc aaa ccg tgc tcg			1488
Ser Lys Pro Ala Thr Ser Ser Arg Ile Val Ser Ile Lys Pro Cys Ser			
485	490	495	
att agt gac ctt			1500
Ile Ser Asp Leu			
500			

<210> 66  
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 <212> PRT  
 <213> Thraustochytrium sp.

<400> 66

Pro Thr Pro Phe Phe Ser Pro Ser Ser Tyr Pro Pro Arg Ala Ile Cys  
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Phe Ile Pro Phe Pro Gly Asn Pro Leu Asp Asn Asn Cys Lys Ala Gly  
 20 25 30

Glu Met Pro Leu Asn Trp Tyr Asn Met Ser Glu Phe Met Cys Gly Lys  
 35 40 45

Val Ser Asn Cys Leu Gly Pro Glu Phe Ala Arg Phe Asp Lys Ser Asn  
 50 55 60

Thr Ser Arg Ser Pro Ala Phe Asp Leu Ala Leu Val Thr Arg Val Val  
 65 70 75 80

Glu Val Thr Asn Met Glu His Gly Lys Phe Leu Asn Val Asp Cys Asn  
 85 90 95

Pro Ser Lys Gly Thr Met Val Gly Glu Phe Asp Cys Pro Gln Asp Ala  
 100 105 110

Trp Phe Phe Asp Gly Ser Cys Asn Asp Gly His Met Pro Tyr Ser Ile  
 115 120 125

Ile Met Glu Ile Gly Leu Gln Thr Ser Gly Val Leu Thr Ser Val Leu  
 130 135 140

Lys Ala Pro Leu Thr Met Asp Lys Asp Asp Ile Leu Phe Arg Asn Leu  
 145 150 155 160

Asp Ala Ser Ala Glu Met Val Arg Pro Asp Val Asp Val Arg Gly Lys  
 165 170 175

Thr Ile Arg Asn Val Thr Lys Cys Thr Gly Tyr Ala Met Leu Gly Lys  
 180 185 190

Met Gly Ile His Arg Phe Thr Phe Glu Leu Ser Val Asp Gly Val Val  
 195 200 205

Phe Tyr Lys Gly Ser Thr Ser Phe Gly Trp Phe Thr Pro Glu Val Phe  
 210 215 220

Ala Gln Gln Ala Gly Leu Asp Asn Gly Lys Lys Thr Glu Pro Trp Cys  
 225 230 235 240

Lys Thr Asn Asn Thr Ser Val Arg Arg Val Glu Ile Ala Ser Ala Lys  
 245 250 255

Gly Lys Glu Gln Leu Thr Glu Lys Leu Pro Asp Ala Thr Asn Ala Gln  
 260 265 270

Val Leu Arg Arg Ser Glu Gln Cys Glu Tyr Leu Asp Tyr Leu Asn Ile  
 275 280 285

Ala Pro Asp Ser Gly Leu His Gly Lys Gly Tyr Ala His Gly His Lys  
 290 295 300

Asp Val Asn Pro Gln Asp Trp Phe Phe Ser Cys His Phe Trp Phe Asp  
 305 310 315 320

Pro Val Met Pro Gly Ser Leu Gly Ile Glu Ser Met Phe Gln Leu Ile  
 325 330 335

Glu Ala Phe Ala Val Asp Gln Asn Ile Pro Gly Glu Tyr Asn Val Ser  
 340 345 350

Asn Pro Thr Phe Ala His Ala Pro Gly Lys Thr Ala Trp Lys Tyr Arg  
 355 360 365

Gly Gln Leu Thr Pro Lys Asn Arg Ala Met Asp Cys Glu Val His Ile  
 370 375 380

Val Ser Ile Thr Ala Ser Pro Glu Asn Gly Gly Tyr Val Asp Ile Val  
 385 390 395 400

Ala Asp Gly Ala Leu Trp Val Asp Gly Leu Arg Val Tyr Glu Ala Lys  
 405 410 415

Glu Leu Arg Val Arg Val Val Ser Ala Lys Pro Gln Ala Ile Pro Asp  
 420 425 430

Val Gln Gln Gln Pro Pro Ser Ala Lys Ala Asp Pro Gly Lys Thr Gly  
 435 440 445

Val Ala Leu Ser Pro Thr Gln Leu Arg Asp Val Leu Leu Glu Val Asp  
 450 455 460

Asn Pro Leu Tyr Leu Gly Val Glu Asn Ser Asn Leu Val Gln Phe Glu  
 465 470 475 480

Ser Lys Pro Ala Thr Ser Ser Arg Ile Val Ser Ile Lys Pro Cys Ser  
 485 490 495

Ile Ser Asp Leu  
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 <212> DNA  
 <213> Thraustochytrium sp.

<220>  
 <221> CDS  
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 act gga gca atg gcc aag ggc att gca tcc gcc gac ttg gtc att gct 96  
 Thr Gly Ala Met Ala Lys Gly Ile Ala Ser Ala Asp Leu Val Ile Ala  
 20 25 30  
 gct ggg aaa cgc aag ata ctt gga tgc ttt ggt gcg gga ggg ctg cct 144  
 Ala Gly Lys Arg Lys Ile Leu Gly Ser Phe Gly Ala Gly Gly Leu Pro  
 35 40 45  
 att tcc ata gtc cgt gaa gca ctg gag aaa att caa caa cac ctg ccc 192  
 Ile Ser Ile Val Arg Glu Ala Leu Glu Lys Ile Gln Gln His Leu Pro  
 50 55 60  
 cac ggc ccc tac gct gtt aac ctc att cac tgc cct ttc gac agc aac 240  
 His Gly Pro Tyr Ala Val Asn Leu Ile His Ser Pro Phe Asp Ser Asn  
 65 70 75 80  
 ttg gaa aag ggc aac gtt gac ctc ttt ctc gag atg ggc gtg aca gtg 288  
 Leu Glu Lys Gly Asn Val Asp Leu Phe Leu Glu Met Gly Val Thr Val  
 85 90 95  
 gta gaa tgc agc gcg ttc atg gaa ctc acg gcc cag gtt gtc cgg tac 336  
 Val Glu Cys Ser Ala Phe Met Glu Leu Thr Ala Gln Val Val Arg Tyr  
 100 105 110  
 cgc gcg tct ggt cta agc aaa agt gcg gac ggt tgc att cgc att gct 384  
 Arg Ala Ser Gly Leu Ser Lys Ser Ala Asp Gly Ser Ile Arg Ile Ala  
 115 120 125  
 cac cgt att att ggc aag gtt tcc aga acc gag ctg gca gaa atg ttt 432  
 His Arg Ile Ile Gly Lys Val Ser Arg Thr Glu Leu Ala Glu Met Phe  
 130 135 140  
 att cgt cca gca cca cag cac ctc ctc caa aaa ctc gta gcc tcc ggc 480

Ile	Arg	Pro	Ala	Pro	Gln	His	Leu	Leu	Gln	Lys	Leu	Val	Ala	Ser	Gly	
145					150					155					160	
gag	ctg	aca	gct	gag	caa	gcc	gag	ctt	gca	aca	cag	gtt	ccg	gtg	gcg	528
Glu	Leu	Thr	Ala	Glu	Gln	Ala	Glu	Leu	Ala	Thr	Gln	Val	Pro	Val	Ala	
				165					170					175		
gat	gac	att	gcg	gtc	gaa	gcc	gac	tcg	ggg	ggg	cat	acc	gac	aac	agg	576
Asp	Asp	Ile	Ala	Val	Glu	Ala	Asp	Ser	Gly	Gly	His	Thr	Asp	Asn	Arg	
			180					185					190			
cct	att	cac	gtc	att	ctt	cct	cta	atc	atc	aac	cta	cgc	aac	cgt	ttg	624
Pro	Ile	His	Val	Ile	Leu	Pro	Leu	Ile	Ile	Asn	Leu	Arg	Asn	Arg	Leu	
		195				200						205				
cat	aaa	gag	ctt	gac	tac	cct	tcg	cat	ctc	cgg	gta	cgt	gtg	ggt	gct	672
His	Lys	Glu	Leu	Asp	Tyr	Pro	Ser	His	Leu	Arg	Val	Arg	Val	Gly	Ala	
	210					215					220					
ggt	ggt	ggt	att	gga	tgt	cct	caa	gcc	gct	ctt	gca	gca	ttt	caa	atg	720
Gly	Gly	Gly	Ile	Gly	Cys	Pro	Gln	Ala	Ala	Leu	Ala	Ala	Phe	Gln	Met	
225					230					235					240	
ggg	gca	gcg	ttt	tta	atc	act	gga	acg	gtg	aac	cag	ctt	gct	cgt	gaa	768
Gly	Ala	Ala	Phe	Leu	Ile	Thr	Gly	Thr	Val	Asn	Gln	Leu	Ala	Arg	Glu	
				245					250					255		
agt	ggc	act	tgt	gac	aac	gtc	cgg	tta	cag	ctc	tca	aag	gcc	acg	tat	816
Ser	Gly	Thr	Cys	Asp	Asn	Val	Arg	Leu	Gln	Leu	Ser	Lys	Ala	Thr	Tyr	
			260					265					270			
agc	gac	gtg	tgt	atg	gct	cct	gct	gcc	gat	atg	ttt	gac	caa	ggc	gtg	864
Ser	Asp	Val	Cys	Met	Ala	Pro	Ala	Ala	Asp	Met	Phe	Asp	Gln	Gly	Val	
		275				280						285				
gag	ctg	caa	gta	ttg	aag	aaa	ggc	acg	ctg	ttc	cca	agt	cgt	gct	aag	912
Glu	Leu	Gln	Val	Leu	Lys	Lys	Gly	Thr	Leu	Phe	Pro	Ser	Arg	Ala	Lys	
		290				295					300					
aag	ctg	tac	gag	ctg	ttc	tgc	aag	tat	gac	tcg	ttt	gag	gca	atg	ccg	960
Lys	Leu	Tyr	Glu	Leu	Phe	Cys	Lys	Tyr	Asp	Ser	Phe	Glu	Ala	Met	Pro	
305					310					315					320	
gct	gaa	gaa	ttg	caa	cgg	gtt	gaa	aag	cgg	att	ttt	caa	aag	tcg	ctt	1008
Ala	Glu	Glu	Leu	Gln	Arg	Val	Glu	Lys	Arg	Ile	Phe	Gln	Lys	Ser	Leu	
				325					330					335		
gct	gaa	gtt	tgg	cag	gag	acc	agt	gac	ttt	tac	att	cat	cgt	atc	aag	1056
Ala	Glu	Val	Trp	Gln	Glu	Thr	Ser	Asp	Phe	Tyr	Ile	His	Arg	Ile	Lys	
			340					345					350			
aac	cct	gag	aaa	atc	aat	cgt	gct	gca	agc	gat	ggc	aaa	ctg	aaa	atg	1104
Asn	Pro	Glu	Lys	Ile	Asn	Arg	Ala	Ala	Ser	Asp	Gly	Lys	Leu	Lys	Met	
		355					360					365				
tcg	ctt	tgc	ttt	cgc	tgg	tac	ctt	ggg	ctt	tcc	tca	ttt	tgg	gcc	aac	1152
Ser	Leu	Cys	Phe	Arg	Trp	Tyr	Leu	Gly	Leu	Ser	Ser	Phe	Trp	Ala	Asn	
		370				375					380					
tct	ggg	gca	caa	gat	cgc	gtc	atg	gac	tat	caa	att	tgg	tgt	ggc	cct	1200
Ser	Gly	Ala	Gln	Asp	Arg	Val	Met	Asp	Tyr	Gln	Ile	Trp	Cys	Gly	Pro	
385					390					395					400	
gct	att	ggc	gct	ttc	aat	gat	ttt	acc	aag	ggc	acg	tac	ctt	gac	gtg	1248
Ala	Ile	Gly	Ala	Phe	Asn	Asp	Phe	Thr	Lys	Gly	Thr	Tyr	Leu	Asp	Val	
				405					410					415		
act	gtt	gca	aag	agt	tac	cct	tgt	gtg	gca	cag	atc	aat	ttg	caa	att	1296

Thr Val Ala Lys Ser Tyr Pro Cys Val Ala Gln Ile Asn Leu Gln Ile  
                   420                                  425                                  430

ttg caa gga gct gcg tat ctg aaa cgc ctt ggt gtc att cgt ttt gac      1344  
 Leu Gln Gly Ala Ala Tyr Leu Lys Arg Leu Gly Val Ile Arg Phe Asp  
                   435                                  440                                  445

cgc atg ctg ctg cag gcc gtc gat atc gac gat cct gta ttt act tac      1392  
 Arg Met Leu Leu Gln Ala Val Asp Ile Asp Asp Pro Val Phe Thr Tyr  
                   450                                  455                                  460

gtg ccg acc cag cca ctt      1410  
 Val Pro Thr Gln Pro Leu  
 465                                  470

<210> 68  
 <211> 470  
 <212> PRT  
 <213> Thraustochytrium sp.

<400> 68

Gly Asp Lys Ser Phe Met Glu Thr Tyr Asn Val Ser Ala Pro Leu Tyr  
 1                                  5                                  10                                  15

Thr Gly Ala Met Ala Lys Gly Ile Ala Ser Ala Asp Leu Val Ile Ala  
                   20                                  25                                  30

Ala Gly Lys Arg Lys Ile Leu Gly Ser Phe Gly Ala Gly Gly Leu Pro  
                   35                                  40                                  45

Ile Ser Ile Val Arg Glu Ala Leu Glu Lys Ile Gln Gln His Leu Pro  
 50                                  55                                  60

His Gly Pro Tyr Ala Val Asn Leu Ile His Ser Pro Phe Asp Ser Asn  
 65                                  70                                  75                                  80

Leu Glu Lys Gly Asn Val Asp Leu Phe Leu Glu Met Gly Val Thr Val  
                   85                                  90                                  95

Val Glu Cys Ser Ala Phe Met Glu Leu Thr Ala Gln Val Val Arg Tyr  
                   100                                  105                                  110

Arg Ala Ser Gly Leu Ser Lys Ser Ala Asp Gly Ser Ile Arg Ile Ala  
                   115                                  120                                  125

His Arg Ile Ile Gly Lys Val Ser Arg Thr Glu Leu Ala Glu Met Phe  
 130                                  135                                  140

Ile Arg Pro Ala Pro Gln His Leu Leu Gln Lys Leu Val Ala Ser Gly  
 145                                  150                                  155                                  160

Glu Leu Thr Ala Glu Gln Ala Glu Leu Ala Thr Gln Val Pro Val Ala  
                   165                                  170                                  175

Asp Asp Ile Ala Val Glu Ala Asp Ser Gly Gly His Thr Asp Asn Arg

180	185	190
Pro Ile His Val Ile Leu Pro Leu Ile Ile Asn Leu Arg Asn Arg Leu		
195	200	205
His Lys Glu Leu Asp Tyr Pro Ser His Leu Arg Val Arg Val Gly Ala		
210	215	220
Gly Gly Gly Ile Gly Cys Pro Gln Ala Ala Leu Ala Ala Phe Gln Met		
225	230	235
Gly Ala Ala Phe Leu Ile Thr Gly Thr Val Asn Gln Leu Ala Arg Glu		
245	250	255
Ser Gly Thr Cys Asp Asn Val Arg Leu Gln Leu Ser Lys Ala Thr Tyr		
260	265	270
Ser Asp Val Cys Met Ala Pro Ala Ala Asp Met Phe Asp Gln Gly Val		
275	280	285
Glu Leu Gln Val Leu Lys Lys Gly Thr Leu Phe Pro Ser Arg Ala Lys		
290	295	300
Lys Leu Tyr Glu Leu Phe Cys Lys Tyr Asp Ser Phe Glu Ala Met Pro		
305	310	315
Ala Glu Glu Leu Gln Arg Val Glu Lys Arg Ile Phe Gln Lys Ser Leu		
325	330	335
Ala Glu Val Trp Gln Glu Thr Ser Asp Phe Tyr Ile His Arg Ile Lys		
340	345	350
Asn Pro Glu Lys Ile Asn Arg Ala Ala Ser Asp Gly Lys Leu Lys Met		
355	360	365
Ser Leu Cys Phe Arg Trp Tyr Leu Gly Leu Ser Ser Phe Trp Ala Asn		
370	375	380
Ser Gly Ala Gln Asp Arg Val Met Asp Tyr Gln Ile Trp Cys Gly Pro		
385	390	395
Ala Ile Gly Ala Phe Asn Asp Phe Thr Lys Gly Thr Tyr Leu Asp Val		
405	410	415
Thr Val Ala Lys Ser Tyr Pro Cys Val Ala Gln Ile Asn Leu Gln Ile		
420	425	430
Leu Gln Gly Ala Ala Tyr Leu Lys Arg Leu Gly Val Ile Arg Phe Asp		
435	440	445
Arg Met Leu Leu Gln Ala Val Asp Ile Asp Asp Pro Val Phe Thr Tyr		



450	455	460
Val Pro Thr Gln Pro Leu		
465	470	
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<223> primer		
<400> 69		
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<210> 70		
<211> 22		
<212> DNA		
<213> Artificial sequence		
<220>		
<223> primer		
<400> 70		
trttsasrta ytggyaacct tg		22
<210> 71		
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<223> primer		
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<223> n = a c g or t		
<400> 71		
atgkcngaag gttgtggcca		20
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<211> 23		
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<400> 72		
ccwgaratra agccrttdgg ttg		23
<210> 73		
<211> 30		
<212> DNA		
<213> Artificial Sequence		
<220>		
<223> primer		

<400> 73  
cggggtaccc gggagccgcc ttggctttgt 30

<210> 74  
<211> 35  
<212> DNA  
<213> Artificial Sequence

<220>  
<223> primer

<400> 74  
aaactgcagc ccgggtccag ctggcaggca ccctg 35

<210> 75  
<211> 798  
<212> DNA  
<213> Shewanella olleyana

<400> 75  
atggcagaag gttgtggcca attattgcag ttcttcatgc tgcacattgg tatgcacacc 60  
ttagttgaaa acggacgttt ccagccttta gaaaatgctt cacaaaaagt acgttgtcgt 120  
ggccaagtac tgccacaaca tgggtgaactg acgtaccgca tgggaagtcac agaaattggt 180  
actcaccctc gcccatagc caaagccaat attgaaatat tgctcaatgg taaagcggtc 240  
gtggacttcc aaaatcttgg ggtgatgatt aaagaagaag gtgaatgtac tcgttacact 300  
gccgactcta ctgaaacaca tacaacctca ggcacagtcc aaaaaaaca cagccacaac 360  
acaccagcat cattaaatgc accgttaatg gcacaagtgc cagacttaag tgaaccagcc 420  
aataaaggcg ttatcccgct gcaacatgtt gaagcgccta tgctgccaga ctacccaaat 480  
cgaaccctg atacgctgcc gttcaccgcg taccatatgt ttgagtttgc aacaggtgac 540  
atcgaaaact gttttggacc tgactttagt atttaccggg gctttattcc gccgcgcacg 600  
ccatgtggtg acttacagct aacaaccggt gttgttgata ttcaaggtaa acgtggcgag 660  
cttaaaaaac cgtcacgtg tatcgctgaa tatgaagtgc caaccgatgc gtggtatttt 720  
gctaaaaaca gtcacgcttc agtgatgcct tactcggtat taatggaaat atcactgcaa 780  
cccaacggct tcattctca 798

<210> 76  
<211> 1042  
<212> DNA  
<213> Shewanella olleyana

<400> 76  
ggcatgatgg ttggtgaagg tatcggcatg gtagcactta agcgcctaga agatgctgag 60  
cgtgatggcg accgtattta ttctgtgatt aaagggtgctg gcgcttcac agacggtaaa 120  
tttaagagta tttatgcacc gcgccctgaa ggccaagcaa aagcattaaa acgagcttat 180  
gatgacgctg gttttgcccc tgaaacagtt ggcttaatcg aagctcacgg tacgggtact 240  
gctgcagggtg atgtagccga atttaacggc cttaaactctg tatttggtga aaacgatcca 300  
actaagcaac acatcgcttt aggttcagtg aaatcacaag tgggtcacac gaaatcaacc 360

gctgggtactg ctggcgtgat taaagctgcc cttgccctgc accataaagt attgccaccg	420
accattaacg tctctaagcc.aaaccctaag cttaatgttg aggattcacc gtttttcgtt	480
aataccgaaa cacgcccattg gatgcctcgc cctgacggca ctcctcgccg tgctgggtatt	540
agctcgttcg gttttgggtg aactaacttc cacttagtat tagaagaata caccctgag	600
cacagccatg atgagaaata ccgtcaacgc caagtggctc aaagcttatt aatgagtgc	660
gataataaag cagccttgat tgcagaagtg aataagctaa ctgcagacat cagcgcgctt	720
aaaggcacag ataacagcag cattgaacaa gctgaacttg ctgcattgc taaactatat	780
gctgttcgca ccatagatac ttcagcagcc cgtttaggtc ttgtgggtatc aagccttaat	840
gaattaacca ctcagcttgg tttagcgtta aagcagctta ataattgatgt tgatgcatgg	900
caactgccat cagggactag ctaccgctct tcagcactca tcacgattaa tgcaaacc	960
-aaggcgacta aaggtaaaaa agcgactaac gcaccgaaag ttgcagcatt gtttgcaggt	1020
caaggttcac aatacctcaa ca	1042

<210> 77  
 <211> 806  
 <212> DNA  
 <213> *Shewanella japonica*

<400> 77	
atggcggaag gttgtggcca attactgcaa ttctttatgc tgcacattgg tatgcacacg	60
ctcgttgaaa atggcogttt ccaaccactt gaaaatgctt cacaaaaagt gcgttgtcgt	120
ggtcaagttc tgccgcagca cggatgaactg acttaccgga tggaaatcac tgaaattggc	180
attcaccctc gcccatatgc caaagcgaat attgatattt tgcttaacgg taaagcggtt	240
gtcgacttcc aaaacttagg tgtcatgatc aaagaagaaa gcgaatgtac gcgctacctt	300
aatgatacgc ccgctgtcga tgcctcagct gatcgaatta attcagcaac caataatatt	360
ctatacccag cggcttcaac caatgcgcca ctcatggctc aactgcctga tttgaatgcc	420
ccaacgaata aaggcgttat cccactgcaa catgttgaag cgccgataat tccagattat	480
ccaaatcgta ctctgatac cctgccattc acggcgatc acatgttcga atttgccact	540
ggcaatattg aaaactgctt tggaccggac tttagtattt accgtgggtt cattccaccg	600
cgcacaccat gtggcgactt acagctaacg actcgattg ttgatattca aggtaaacgt	660
ggcgaattga aaaagccatc atcgtgtatc gcagaatatg aagtgccaac tgatgcatgg	720
tatttcgcta aaaacagcca cgcctcggtc ataccttatt cagtgttgat ggaaatttca	780
ctgcaaccca atggcttcac ctcagg	806

<210> 78  
 <211> 1042  
 <212> DNA  
 <213> *Shewanella japonica*

<400> 78	
ggtatgctgg ttggtgaagg cattggcatg gtggcattaa aacgtcttga agatgctgag	60

cgtgacggtg accgtattta ctgagtcatt aaaggggtcg gcgcttcac	120
ttcaaatcaa tttatgcacc tcgacctgaa ggccaagcta aagcgctgaa gcgtgcttat	180
gatgacgccc gctttgcacc tgaaaccgtt ggcttaattg aagctcacgg aacaggcact	240
gcagcgggtg atgtggcaga atttaattgg cttaaactctg ttttgggtga gaatgactca	300
acaaagcaac acattgcttt aggttcagtt aagtcacaag tgggccatac taaatcaact	360
gcgggaaccg cgggtgtgat taaagcggcg ttagcactgc atcataaagt gctgccgcca	420
accatcaacg tctctaagcc taaccetaag cttaatgttg aggattcacc gtttttcatt	480
aacactgaaa ctgcaccttg gatgcctcgc cctgatggca caccacgccc agctggtata	540
agttcgttcg gttttgggtg cacaaacttc cacttagtac tagaagaata cagcccagag	600
cacagccgtg atgagaaata tcgtcagcgc caagtagcac aaagcttatt gattagcgct	660
gacaataaag ctgagctcat tgcagaaatc aacaagctta acgctgacat cagcgcgctt	720
aaaggcacag ataacagcag catcgaaaca gctgaacttg cccgcattgc taaactatat	780
gctgttcgca ctttagatac ttcagcagtc cgtttgggtc ttgtgggtctc aagccttaat	840
gaattaacca ctcaacttgg tttagcgtta aagcagctaa gtaacgacgc tgaagcatgg	900
caattaccat caggtacgag ctatcgctca tctgcgctca tcacgattaa tgccaaccaa	960
aagacgacta aaggtaaaaa agcagctaac acaccgaaag tagcagcatt atttgcaggt	1020
caagggttcg aatatctcaa ca	1042

<210> 79  
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 <212> DNA  
 <213> Artificial Sequence  
  
 <220>  
 <223> restriction enzyme site  
  
 <400> 79  
 catatg

6

<210> 80  
 <211> 192  
 <212> DNA  
 <213> Schizochytrium sp.

<220>  
 <221> misc\_feature  
 <222> (1)..(7)  
 <223> BspHI restriction site

<220>  
 <221> misc\_feature  
 <222> (188)..(192)  
 <223> SacII restriction site

<400> 80	
tcatgaagcc ggttgctccg aagttctacg cgcgtctcaa cattgacgag caggacgaga	60
cccgtgatcc gatcctcaac aaggacaacg cgccgtcttc cagctctagc tctcttcca	120

gctcttccag ctcttccagc ccgtcgccag ctccgtccgc cccagtgcaa aagaaggctg 180  
ctccggccgc gg 192

<210> 81  
<211> 717  
<212> DNA  
<213> Nostoc sp.

<220>  
<221> CDS  
<222> (4)..(714)

<400> 81  
taa ttg ttg cag cat act tgg cta cca aaa ccc cca aat tta acc tta 48  
Leu Leu Gln His Thr Trp Leu Pro Lys Pro Pro Asn Leu Thr Leu  
1 5 10 15  
ttg tca gat gaa gtt cat ctc tgg cgc att ccc ctt gac caa cca gaa 96  
Leu Ser Asp Glu Val His Leu Trp Arg Ile Pro Leu Asp Gln Pro Glu  
20 25 30  
tca cag cta cag gat tta gcc gct acc tta tct agt gac gaa tta gcc 144  
Ser Gln Leu Gln Asp Leu Ala Ala Thr Leu Ser Ser Asp Glu Leu Ala  
35 40 45  
cgt gca aac aga ttt tat ttt ccc gaa cat cgc cgg cgt ttt act gct 192  
Arg Ala Asn Arg Phe Tyr Phe Pro Glu His Arg Arg Arg Phe Thr Ala  
50 55 60  
ggg cgt ggt att ctc cgc agt atc ttg ggg ggc tat ttg ggt gtg gaa 240  
Gly Arg Gly Ile Leu Arg Ser Ile Leu Gly Gly Tyr Leu Gly Val Glu  
65 70 75  
cca ggg caa gtt aaa ttt gat tat gaa tcc cgt ggt aaa cca ata tta 288  
Pro Gly Gln Val Lys Phe Asp Tyr Glu Ser Arg Gly Lys Pro Ile Leu  
80 85 90 95  
ggc gat cgc ttt gcc gag agt ggt tta tta ttt aac ttg tca cac tcc 336  
Gly Asp Arg Phe Ala Glu Ser Gly Leu Leu Phe Asn Leu Ser His Ser  
100 105 110  
cag aac ttg gcc ttg tgt gca gtc aat tac acg cgc caa atc ggc atc 384  
Gln Asn Leu Ala Leu Cys Ala Val Asn Tyr Thr Arg Gln Ile Gly Ile  
115 120 125  
gat tta gaa tat ctc cgc ccc aca tct gat tta gaa tcc ctt gcc aaa 432  
Asp Leu Glu Tyr Leu Arg Pro Thr Ser Asp Leu Glu Ser Leu Ala Lys  
130 135 140  
agg ttc ttt tta ccg cga gaa tat gaa tta ttg cga tcg cta ccc gat 480  
Arg Phe Phe Leu Pro Arg Glu Tyr Glu Leu Leu Arg Ser Leu Pro Asp  
145 150 155  
gag caa aaa caa aaa att ttc ttt cgt tac tgg act tgt aaa gag gct 528  
Glu Gln Lys Gln Lys Ile Phe Phe Arg Tyr Trp Thr Cys Lys Glu Ala  
160 165 170 175  
tat ctt aaa gca acg ggt gac ggc atc gct aaa tta gag gaa att gaa 576  
Tyr Leu Lys Ala Thr Gly Asp Gly Ile Ala Lys Leu Glu Glu Ile Glu  
180 185 190  
ata gca cta act ccc aca gaa cca gct aag tta cag aca gct cca gcg 624  
Ile Ala Leu Thr Pro Thr Glu Pro Ala Lys Leu Gln Thr Ala Pro Ala  
195 200 205

tgg agt ctc cta gag cta gtg cca gat gat aat tgt gtt gct gct gtt 672  
 Trp Ser Leu Leu Glu Leu Val Pro Asp Asp Asn Cys Val Ala Ala Val  
           210                          215                          220

gcc gtg gcg ggt ttt ggc tgg cag cca aaa ttc tgg cat tat tga 717  
 Ala Val Ala Gly Phe Gly Trp Gln Pro Lys Phe Trp His Tyr  
           225                          230                          235

<210> 82  
 <211> 237  
 <212> PRT  
 <213> Nostoc sp.

<400> 82

Leu Leu Gln His Thr Trp Leu Pro Lys Pro Pro Asn Leu Thr Leu Leu  
 1                          5                          10                          15

Ser Asp Glu Val His Leu Trp Arg Ile Pro Leu Asp Gln Pro Glu Ser  
           20                          25                          30

Gln Leu Gln Asp Leu Ala Ala Thr Leu Ser Ser Asp Glu Leu Ala Arg  
           35                          40                          45

Ala Asn Arg Phe Tyr Phe Pro Glu His Arg Arg Arg Phe Thr Ala Gly  
           50                          55                          60

Arg Gly Ile Leu Arg Ser Ile Leu Gly Gly Tyr Leu Gly Val Glu Pro  
 65                          70                          75                          80

Gly Gln Val Lys Phe Asp Tyr Glu Ser Arg Gly Lys Pro Ile Leu Gly  
                           85                          90                          95

Asp Arg Phe Ala Glu Ser Gly Leu Leu Phe Asn Leu Ser His Ser Gln  
           100                          105                          110

Asn Leu Ala Leu Cys Ala Val Asn Tyr Thr Arg Gln Ile Gly Ile Asp  
           115                          120                          125

Leu Glu Tyr Leu Arg Pro Thr Ser Asp Leu Glu Ser Leu Ala Lys Arg  
           130                          135                          140

Phe Phe Leu Pro Arg Glu Tyr Glu Leu Leu Arg Ser Leu Pro Asp Glu  
 145                          150                          155                          160

Gln Lys Gln Lys Ile Phe Phe Arg Tyr Trp Thr Cys Lys Glu Ala Tyr  
                           165                          170                          175

Leu Lys Ala Thr Gly Asp Gly Ile Ala Lys Leu Glu Glu Ile Glu Ile  
           180                          185                          190

Ala Leu Thr Pro Thr Glu Pro Ala Lys Leu Gln Thr Ala Pro Ala Trp  
           195                          200                          205

Ser Leu Leu Glu Leu Val Pro Asp Asp Asn Cys Val Ala Ala Val Ala  
210 215 220

Val Ala Gly Phe Gly Trp Gln Pro Lys Phe Trp His Tyr  
225 230 235